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Original article

## Surgical management of knee dislocations with ligament reconstruction associated with a hinged external fixator



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### ABSTRACT

**Introduction:** Knee dislocations are defined as ligament injuries involving at least two of the four most important knee ligaments. Results from recent studies have shown a tendency towards improvement of the functional outcomes with use of an articulated external fixator during the postoperative period following multiligament reconstruction. Our hypothesis was that good knee stability and early gain of range of motion could be achieved with the use of the external fixator after ligament reconstructions.

**Methods:** Fourteen patients with knee dislocations were evaluated after multiligament reconstruction in association with use of a lateral monoplanar external fixator for six weeks. Reconstructions were performed using grafts from a tissue bank. Range of motion was measured after one, two, three, six, twelve months and at the final evaluation at a mean time of 49 months. The assessments were made using objective and subjective IKDC, Lysholm and Tegner scales.

**Results:** The mean scores were 71.7 for the subjective IKDC score, 81.5 for the Lysholm score. No patient was able to return to previous Tegner score. Out of the 45 ligament reconstructions performed, only four failed during the follow-up time. The mean range of motion of the knee presented a progressive increase from the first to the twelfth month, from 67.8° to 115.7°. Two cases of superficial infection on the site of the external fixator pins were observed.

**Conclusion:** The use of an external fixator enabled early rehabilitation with range of motion gains starting from the first postoperative month, a low rate of reconstruction failure and minimal complications. Nevertheless, none of the patients returned to the level of activity prevailing prior to the injury.

**Level of evidence:** Level IV, retrospective therapeutic case series.

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### 1. Introduction

Knee dislocations are defined as ligament injuries involving at least two of the four most important knee ligaments and account for approximately 0.2% of orthopedic injuries [1,2].

Despite their low incidence, these injuries have been widely studied recently because of their high morbidity, the difficulty in returning to the level of activity prior to the injury and the high complication rate [2–4].

For some issues relating to surgical treatment of knee dislocations, there is still no consensus in literature. Among these, are the best time for surgery, the best type of graft and the use of articulated external fixator during the immediate postoperative period [1].

Results from recent studies have shown a tendency towards improvement of the functional outcomes with use of an articulated external fixator during the postoperative period following multiligament reconstruction, although some series also presented good functional results without using these devices [3,5,6].

The type of articulated external fixator has also not been established in the literature. Some studies have used circular or half-ring assemblies that are specific for knee dislocation, while others used monolateral assemblies in the lateral side of the affected limb [7,8].

Monolateral assemblies have shown similar result when compared to bilateral assemblies with regard to tibial translation, in anterior and posterior drawer tests and Lachman tests in Fitzpatrick's study [9].

The objective of the present study was to present medium-term functional results for patients with knee dislocation treated by means of ligament reconstruction in association with a monolateral articulated external fixator in the immediate postoperative

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period. Our hypothesis was that good knee stability and early gain of range of motion could be achieved with the use of the external fixator after ligament reconstruction.

## 2. Methods

A prospective evaluation of a retrospective cohort was conducted on patients with knee dislocation that underwent ligament reconstruction in our department. This study was approved by the research ethics committee of our institution and all patients included gave their informed consent. Inclusion criteria were knee dislocations types III and IV according to Schenck classification with less than three months from the initial trauma [10] and exclusion criteria were vascular repair due to injury of the popliteal artery (1 case), fractures in the knee region in association with ligament lesions (1 case), extension lag and less than 120 degrees of knee flexion. Fourteen patients (mean age 29.3) were included.

Three of the authors in conjunction performed all surgeries. The same surgeons performed postoperative evaluation.

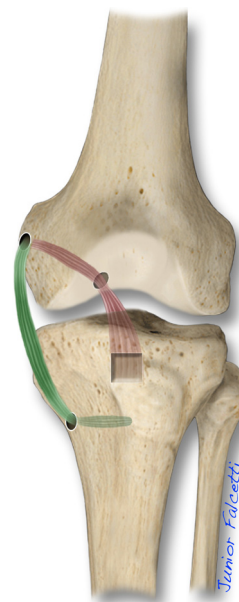
The technique chosen for the reconstructions, and the type of graft used were based on the type of injury presented by each patient. Allografts were used in all cases. The types of lesions are described in Table 1.

To reconstruct the posterior cruciate ligament (PCL), a single band technique with an outside-in tunnel in the femur was used, with inlay fixation in the tibia [11]. If this procedure was associated with medial collateral ligament (MCL) reconstruction, a long Achilles tendon graft with a bone plug was chosen and combined reconstruction with a single femoral tunnel was performed (Fig. 1) [12].

Reconstructions of the anterior cruciate ligament (ACL) were performed with the anatomical outside-in technique and when combined with injuries of the posterolateral corner (PLC), reconstructions were performed with the single femoral tunnel technique for ACL and PLC (Fig. 2) [13–15].

For all the reconstructions, a monoplanar articulated external fixator was used (LRS, Orthofix, Bussolengo, Italy), in the lateral side of the lower limb, with four pins in the tibia and four pins in the femur. Femoral pins were put proximal to femoral tunnels and tibial pins distal to tibial tunnels.

The fixator was assembled using a guidewire at the most isometric femoral point, which referenced placement of femoral and tibial pins. This point for wire insertion was as described by Stannard et al. in their initial series using external fixators for knee dislocations



**Fig. 1.** Schematic drawing showing combined reconstruction of the posterior cruciate ligament (red ligament) and the medial collateral ligament (green ligament) with Achilles tendon allograft and single femoral tunnel.

[7]. Immediately proximal to the crossing point of LCL and popliteus tendon, on the lateral condyle; or determined by radioscopy, at a point equidistant from inferior and posterior joint spaces, on the Blumensatt line (Fig. 3) [7].

During the hospital stay, on the first two postoperative days, all patients performed highest range of motion exercises and partial weight-bearing with the aid of crutches was allowed.

After release from hospital, patients continued to receive physiotherapeutic follow-up, with emphasis on gaining range of motion and progression of weight-bearing, according to how well this was tolerated. Normally, full weight-bearing was achieved at eight weeks after surgery.

Strengthening regimen program began with isometric exercises for the first two weeks when limb elevation was started. Open kinetic chain exercises were avoided for four months.

The external fixators were removed at the operation room under sedation after six weeks. No other type of immobilization, like a brace, was used.

**Table 1**  
Demographic characteristics of patients included in the study.

Patient	Age (years)	Trauma mechanism	Time between lesion and reconstruction (months)	Follow-up (months)	Lesion type
1	28	Motorcycle	0.5	58	IIIL
2	33	Motorcycle	0.5	58	IIIL
3	38	Run over	3	54	IV
4	21	Jiu-jitsu	3	54	IIIL
5	28	Motorcycle	3	52	IIIL
6	29	Run over	3	52	IIIM
7	23	Motorcycle	1.5	47	IIIL
8	27	Motorcycle	3	47	IIIL
9	29	Soccer	3	47	IIIL
10	31	Motorcycle	3	46	IIIL
11	36	Run over	3	46	IIIL
12	43	Motorcycle	3	45	IIIM
13	22	Motorcycle	3	44	IV
14	23	Jiu-jitsu	3	41	IV
Average	29.3		2.53	49.35	

IIIL: ACL, PCL and PLC lesion; IIIM: ACL, PCL and MCL lesion; IV: ACL, PCL, PLC and LCL lesion; ACL: anterior cruciate ligament, PCL: posterior cruciate ligament, MCL: medial collateral ligament, LCL: lateral collateral ligament, PLC: posterior lateral corner.

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