Concomitant Reconstruction of Anterior Cruciate Ligament and Medial Collateral Ligament

Surgical procedure and clinical outcomes

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The purpose of this paper was to evaluate the postoperative clinical outcomes of combined anterior cruciate ligament (ACL) and medial collateral ligament (MCL) reconstruction and to briefly describe the surgical procedure. The current study is a retrospective observational analysis, which included 12 patients with acute ACL and grade III MCL injuries. Combined ACL-MCL reconstruction was performed using bone-tendon-bone patellar autograft and semitendinosus and gracilis autograft, respectively. Preoperative and postoperative assessments were performed for each patient using the same protocol. Combined ACL-MCL reconstruction is associated with improved postoperative results. No recurrent knee instability was reported at the end of follow-up period. In conclusion, acute ACL and grade III MCL injuries can be successfully treated by combined ACL-MCL reconstruction, which is an effective option for the treatment of these patients, associated with good clinical results.

Keywords: Anterior cruciate ligament, medial collateral ligament, instability, combined reconstruction.

Medial collateral ligament (MCL) lesions are the most common ligamentous injuries of the knee [1] and in almost 95% of the cases are accompanied by anterior cruciate ligament (ACL) tears [2, 3]. Concomitant ACL-MCL injuries can be associated with important rotatory laxity, valgus and sagittal instability [4, 5]. The therapeutic options of ACL and MCL injuries are either nonsurgical treatment of MCL and ACL reconstruction or simultaneous ACL-MCL reconstruction [6-8]. Some authors consider that MCL injuries can heal conservatively in 8-12 weeks and only in rare cases the reconstruction of both ligaments is necessary. Chronic anterior or medial knee instability associated with clinical symptoms is an indication for surgery [9]. Furthermore, Duffy et al. recommend surgical treatment in symptomatic grade II or III MCL tears, in case of persistent laxity or instability [10].

On the other hand, more recent studies suggest that concomitant reconstruction of ACL and MCL is useful in order to regain knee stability and to reduce the stress on ACL graft [11, 12]. According to Gale et al., the concurrent reconstruction of MCL is recommended in grade III-MCL injuries [13]. Moreover, Ahn et al. [14] showed that untreated grade II-MCL injuries can be responsible for knee instability after isolated ACL reconstruction. The authors strongly recommend the concomitant management of ACL and MCL lesions. In a study performed on 57 patients (37 with isolated ACL tears and 20 with simultaneous ACL-MCL injuries), Zaffagnini et al. revealed that single ACL reconstruction in patients with combined ACL and MCL lesions can lead to residual laxity [15].

The objective of this paper was to evaluate the postoperative clinical outcomes of combined anterior cruciate ligament and medial collateral ligament reconstruction and to briefly describe the surgical procedure. The hypothesis was that one-stage ACL-MCL reconstruction will improve the clinical outcomes of these patients.

Experimental part

The study was approved by the Institutional Review Board. The current study represents a retrospective observational analysis of 12 patients with acute ACL and grade III MCL injuries who underwent combined ACL-MCL reconstruction between January 2015 and December 2016.

The inclusion criteria was represented by the presence of combined acute ACL and grade III MCL lesions. There were excluded from the study: patients with pre-existing knee osteoarthritis, previous surgical procedures on the knee, recurrent ACL lesions, posterior cruciate ligament or LCL tears associated with ACL-MCL.

In all cases, the reconstruction was performed as one-stage surgical procedure. Twelve patients (8 males and 4 females) with a mean age of 30.25 ± 6.82 met the inclusion criteria and were eligible for the study. Each patient was evaluated preoperatively and postoperatively (at 12 months) using the same protocol: Lachman test, pivot shift test, valgus stress test, instrumental differential antero-posterior laxity, differential medial opening on valgus stress radiographs, the International Knee Documentation Committee (IKDC) subjective and objective knee scores, the Lysholm score and the Tegner activity score. The surgical procedure was performed by a single surgeon. The pain management included the administration of etoricoxib 120 mg, one hour prior to surgery and 24 hours postoperatively [16]. A proper control of pain is essential especially after the surgical procedure, in order to obtain a rapid rehabilitation [17].

The patient is positioned supine with a tourniquet in the proximal thigh with the knee flexed at 90 degrees, held in position with a lateral post and a foot roll. An incision of about 10 to 15 cm is performed on the antero-medial aspect of the knee, intersecting the joint line. The hamstrings tendons are harvested using a stripper and used as MCL autograft (Figure 1).

A *V* shaped tunnel is drilled into the proximal tibia at the level of the distal superficial MCL insertion. The femoral

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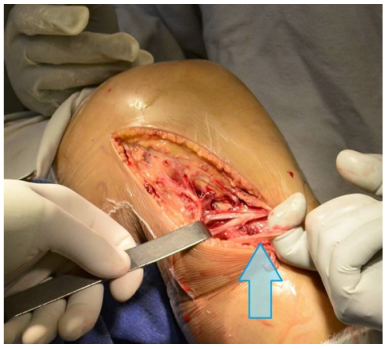

Fig. 1. Hamstrings harvest for MCL autograft

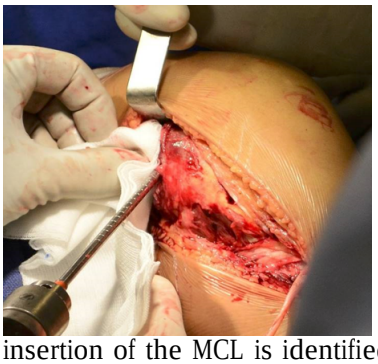

Fig. 2. Femoral tunnel drilling for MCL autograft

insertion of the MCL is identified approximately 3 mm proximal and 5 mm posterior to the medial epicondyle. After the insertion point is found, a tunnel is reamed using an ACL guide to a depth of 30 mm. A loop is left in place for later graft passage (fig. 2).

The next step of the procedure is harvesting the patellar tendon in a standard fashion and using it as the ACL graft (fig. 3). Outside-in femoral and tibial guides are used both for the femoral and the tibial tunnels of the ACL. The graft is passed through the femoral and tibial tunnels from proximal to distal. The ACL graft is then fixed with 2 bioabsorbable interference screws with the knee positioned in 30º of flexion and a posterior drawer.

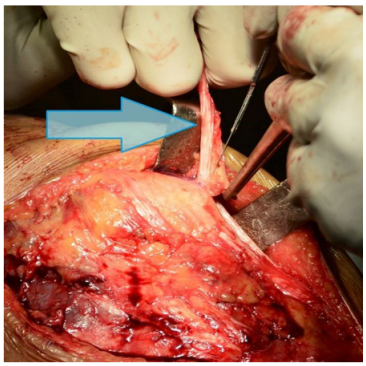

Fig. 3. Bone-tendon-bone harvest for ACL autograft

The hamstrings graft is passed through the *V* shaped tibial tunnel, then between layers 2 and 3 and finally is pulled through the femoral tunnel (fig. 4). The knee is positioned in 30º of flexion and neutral rotation with a slight varus applied by the assistant with concomitant traction applied to the graft. The graft is fixed in the femoral tunnel with a bioabsorbable interference screw. In order to

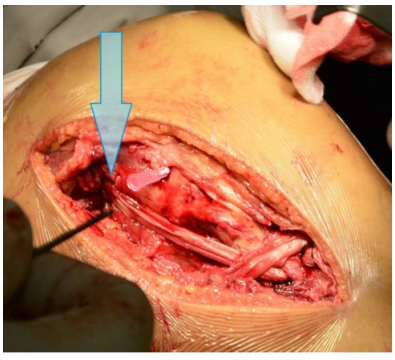

Fig. 4. MCL passage through V-shaped tunnel and femoral tunnel

Fig. 5. Femoral fixation for the MCL with a bioabsorbable screw

recreate the distal insertion of the deep MCL, a suture anchor was inserted distal to the joint line at about 10- 12 mm, to additionally secure the autograft (fig. 5).

The statistical analysis was performed using the Statistical Package for Social Sciences (SPSS). The paired t-test was used in order to compare the data before and after the surgery. The value of $p < 0.05$ was correlated with statistical significance.

Results and discussions

Clinical testing showed improved postoperative results concerning the Lachman test, the pivot shift test and the valgus stress test in all cases. The instrumental differential antero-posterior laxity using Rolimeter arthrometer decreased from 7.53±1.45 preoperatively to 0.82±0.39 postoperatively, with a statistically significant difference. The mean value of the differential medial opening on valgus stress radiographs decreased from an average of 5.67±1.20 preoperatively to 0.87±0.38 after surgery and the difference was statistically significant.

Objective IKDC score improved from severely abnormal or abnormal preoperatively to nearly normal or normal at 12 months after the surgery. The mean subjective IKDC score and Lysholm score significantly increased postoperatively. According to the Tegner activity scale, all patients returned to the activity level registered before the injury (table 1). The results of the present study revealed that the combined reconstruction of ACL - grade III MCL was associated with improved clinical outcomes.

However, the studies published regarding the optimal management of ACL-MCL injuries have controversial results [18-21]. The association of conservative treatment of MCL and secondary ACL reconstruction is an effective option as demonstrated in several studies [22- 25]. For example, according to Halinen et al., non-operative management of MCL tears is associated with rapid rehabilitation of flexion and quadriceps muscle strength [26].

On the other hand, Battaglia et al. [27] showed that isolated ACL reconstruction in patients diagnosed with concomitant ACL-MCL injuries may result in poor outcomes. In this case, ACL healing can be affected, which can cause late graft failure. Zhang et al. [2] demonstrated that combined ACL-MCL reconstruction determined improved postoperative outcomes both post-operatively and at the end of the follow-up period. Another study evaluated the short term results in patients with grade II MCL lesions associated with ACL rupture and concluded that valgus and anterior stability improved in all cases. IKDC score was graded as nearly normal or normal postoperatively and Lysholm score improved in all patients [28]. Their results are consistent with the results obtained in our study.

Contrarily, Linen et al., in a study performed on 47 patients with combined ACL-grade III MCL injuries, divided into two groups – one with MCL nonoperative treatment, followed

Test/score	Mean values ± standard deviation [min; max]		p value
	Preoperative	Postoperative	
Lachman test	Grade III	Negative	-
Pivot shift test	Grade III	Negative	-
Valgus stress test	Grade III	Negative	-
Differential medial knee opening (mm)	5.67 ± 1.20 [4.4, 8.2]	0.87 ± 0.38 [0.4, 1.8]	< 0.01
Instrumental differential AP laxity (mm)	7.53 ± 1.45 [5.5, 10.5]	0.82 ± 0.39 [0.4, 1.5]	< 0.01
IKDC subjective score	48.66 ± 6.37 [38.5, 58.6]	88.49 ± 4.76 [78.2, 94.6]	< 0.01
IKDC objective score	severely abnormal (5 cases – 41.67%) abnormal (7 cases – 58.33%)	nearly normal (3 cases – 25%) normal (9 cases – 75%)	-
Lysholm score	60.67 ± 3.33 [56, 66]	90.5 ± 3.92 [86, 98]	< 0.01

Table 1
COMPARATIVE ANALYSIS OF CLINICAL PARAMETERS AND KNEE SCORES

by ACL reconstruction and the other with simultaneous ACL-MCL reconstruction, concluded that no statistically significant differences were registered between the two categories of patients [29]. Moreover, Westermann et al. [30] showed better results for patients with MCL nonoperative treatment, followed by ACL reconstruction. Combined ACL-MCL reconstruction was related to frequent stiffness, unfavorable outcome and reduced activity at follow-up.

The main limitations of the current study are related to the reduced number of patients and to the retrospective design. Moreover, a comparative analysis between isolated ACL reconstruction and combined ACL-MCL reconstruction may reveal more properly the potential advantages or disadvantages of each technique. Due to technological progress in the field, we can expect further improvements in knee sports surgery [31-34].

Conclusions

The simultaneous ACL-MCL reconstruction is an effective option for the treatment of patients with combined ACL and MCL acute injuries, associated with favorable clinical outcomes.

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