



Avoid post operative bracing to reduce ACL rerupture rates

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Abstract

Purpose It has been quoted that the graft is more prone to injury in the early stages of ligamentization between 3 and 6 months when the muscles are weak and compliance with post-op protocol is waning. Purpose of this study was to evaluate the functional outcome of avoiding postoperative bracing following ACL reconstruction and early enhanced recovery protocol on the reinjuries of graft.

Methods Thirty-two consecutive patients who underwent arthroscopic ACL reconstruction by a single surgeon in the same specialist center between October 2015 and May 2017 were included in the study. All the patients were educated regarding rehabilitation before the index surgery and preoperative quadriceps exercises had been initiated. Rehabilitation was undertaken as per a standard protocol with emphasis on early mobilization. No brace was used. Patients were followed up between 3 months and 1 year. Lysholm knee scores were evaluated at 6 and 12 months postoperatively.

Results No failures were noted (failure defined as instability, stiffness or persistent pain). The average Lysholm knee score at 6 months was 88 and at 12 months period was 91. No statistical significance ($P > 0.00001$) was noted in the scores between braced and unbraced at 1 year.

Conclusion ACL rehabilitation without a knee brace can indirectly prevent rerupture and is a cheaper as well as a safer method with better outcomes.

Keywords Rerupture · ACLR · Bracing · Lysholm score

Introduction

One of the most common traumatic derangements of the knee is anterior cruciate ligament rupture. Arthroscopic ACL reconstruction (ACLR) is a well-accepted treatment of ACL deficient knees. ACLR has constantly evolved with time, for example, transtibial to transportal [1], single bundle to double bundle, and isometric grafts. Despite this, the incidence of ACL rerupture within the first year after reconstruction is 9% in young non-athletes [2].

Postoperative bracing following ACLR is common. The reasons for bracing could be various like pain management, controlling the range of movements, and external support to the knee [3]. Postoperative quadriceps muscle activation

deficit which leads to locking of the knee and fall [4] as well as widening of the bone tunnel during accelerated rehabilitation protocol causing graft laxity [5] is feared by the surgeon. Average bracing period is from 3 weeks to 3 months [6–10]. However, in recent years, the effectiveness of post-op bracing (protocol) has been questioned. Muscle inhibition caused due to postoperative bracing will place a higher load on the repair. We now have newer techniques wherein we can easily achieve an isometric graft. We also have increasingly rigid fixation methods. Since the last few years, there has been a trend toward early muscle-strengthening exercises and range of movement [11]. ACLRs are now done as day care.

Aim of our study was to evaluate the functional outcome of ACLR using a structured rehabilitation protocol without bracing. We hypothesized that thorough preoperative patient education, undertaking of a sound surgical technique and rehabilitation without brace would lead to a significant reduction in failure rates as compared to those published in the literature.

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Materials and methods

This is a retrospective cohort analysis. Thirty consecutive patients who underwent arthroscopic ACL reconstruction by a single surgeon in the same specialist center between October 2015 and May 2017 were included in the study. Patients with previous fractures and deformities around the knee as well as chondral injuries were excluded.

A detailed history of the traumatic episode along with present complaints was taken. All the patients were educated regarding enhanced rehabilitation protocol before the index surgery and pre operative quadriceps and hamstring-strengthening exercises had been initiated. Patients underwent anterior cruciate ligament reconstruction using a double-bundle technique with a quadrupled semitendinosus graft.

The graft was harvested using a closed tendon stripper and secured with an ACL closed-loop endobutton on the femoral side and bio-screw on the tibial side. Emphasis was given to anatomical tunnel using the medial portal entry, isometric graft, cyclical loading, and rigid fixation. Rehabilitation was undertaken as per an enhanced recovery protocol with emphasis on early mobilization and full weight bearing from postoperative day 1.

Enhanced recovery protocol comprises of 90° of knee bending within the first 24 h followed by stair climbing in the next 24 h. In the first 2 weeks, range of movement exercises along with open chain exercises was administered. After the pain subsides, quadriceps- and hamstring-strengthening exercise was initiated for the first 3 months. In the next 3 months, patient was taught proprioception exercises. These exercises included single leg balancing and half squats. Six months from the surgery, the patient is initiated on agility training to prepare them for return to sporting or high-demanding activities. No brace was used at any given time before or after the surgery. Patients were followed up for 1 year. Lysholm knee scores were evaluated at 6 and 12 months postoperatively. Lysholm knee score is evaluated on the basis of eight components, i.e., limp, locking, pain, stair climbing, support, instability, swelling, and squatting. A score of 95–100 is considered as excellent, 84–94 is good, 65–83 is fair, and less than 65 is poor [12]. Thigh girth was measured and compared to the opposite limb. A point 15 cm proximal to the medial joint line was taken as the common reference point for measurement of thigh girth. Informed consent was obtained from all individual participants included in the study. All procedures respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2000(5), as well as the national law.

Results

No surgical or postsurgical complications (instability, stiffness or pain) were encountered in our study. However, one patient had superficial infection from the graft harvest site which was treated with antibiotics and dressing. Another patient presented with stiffness of the knee on his second follow-up which was treated adequately with aggressive physiotherapy and both cases resolved uneventfully. The Lysholm knee scores for all the patients were recorded at 6 and 12 months from the day of surgery. The average score was 88 (73–99) at 6 months and 91 at 12 months (Fig. 1). As compared to scores in the braced group in a study conducted by McDevitt et al., no statistical significance was noted between our 6 months (t -value: 9.891) and their 12 months scores ($p < 0.0001$). Thigh girth at 6 months was an average of 2.5 cm less as compared to the opposite limb which improved to a difference of 1 cm at 12 months (Fig. 2).

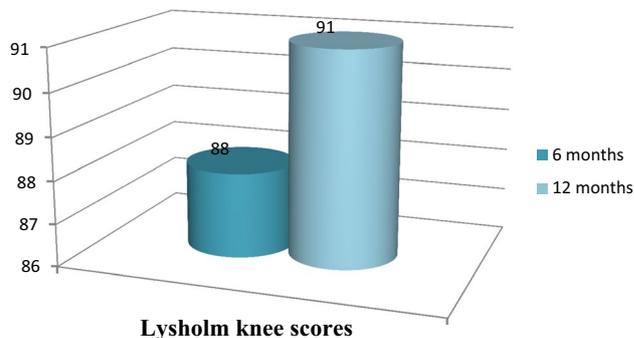


Fig. 1 Depicting the Lysholm knee scores at 6 and 12 months

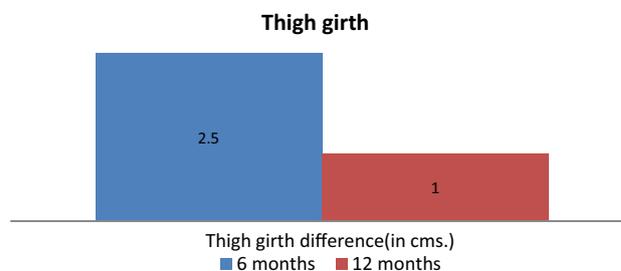


Fig. 2 Difference in the thigh circumference at 6 and 12 months post-operatively

Discussion

The fear of early graft failure compels surgeons to employ bracing post-ACLR surgery. Bracing has been supported in the literature for the following advantages: bracing protects repair by reducing the mechanical loads during early range of motion [13], improves joint proprioception [14], psychologically increases the stability in the knee [15], and prevents widening of the bone tunnel during accelerated rehabilitation [16]. This reliability assists early mobilization without fear of uncontrolled knee buckling. The negative side of post-op bracing was muscle atrophy [17], reduction in knee extension velocity [18], fatigability [19], and cost [20].

However, despite widespread use of post-op bracing, between 10 and 15% [21, 22] reconstructed ACL have failed. Surgical technique error is the most common reason for graft failure [23]. These rates are rather high. Compared to these reports, our zero rerupture incidences are, we believe, the acid test for advocating avoidance of brace.

Ours is the first study to the best of our knowledge that has used Lysholm score assessment at 6 months. Furthermore, our 6-month Lysholm scores were comparable to those at 1 year in studies that have used post-op bracing [24]. At 6 months, our scores were 90% that of our 12-month knee score. Limitations of our study were that it is a retrospective cohort study with a small sample size.

Thigh girth comparison at 6 and 12 months was not significant as compared to the contralateral lower limb in our study. Risberg et al. [25] concluded in his randomized controlled trial that postoperative bracing increased the risk of thigh muscle atrophy at 3 months. They used computed tomography to evaluate the thigh muscle girth of bilateral lower limbs and compared it as a percentage.

A prospective, randomized multicentric study carried out by McDevitt et al. [26] compared the results between braced and unbraced groups in postoperative ACLR patients. They concluded that no difference in knee stability, Lysholm knee scores, and range of movements was noted between the two groups. Two braced and three non-braced subjects suffered reinjuries out of 95 subjects. The braced group's score was 94 and unbraced was 93. The rehab protocol followed in this study included early active, active assisted, passive range of motion, and hyperextension exercises. No restrictions for range of movement exercises and concentric hamstring and quadriceps muscle-strengthening exercises were carried out. Patients started bearing full weight on the operated limb 3 weeks after surgery. In our study, enhanced recovery protocol was followed. Weight bearing within 24 h followed by stair climbing within 48 h triggers the quadriceps faster

than the usual time taken by other studies. This leads to shorter recovery period as well as early takeover by the thigh muscles providing protection to the graft.

Techniques in ACLR have evolved over the last decade. The purpose of research in rehabilitation protocol as well as surgical procedure is centered toward speeding up the recovery phase and substituting a tendon which has the biomechanics of an intact ACL.

A study conducted by Salmon et al. stated that 41% of the graft ruptured within the first 12 months after surgery. This study also concluded that a year after surgery, no significant difference in the rupture rate was seen between the reconstructed and contralateral knee ACL [27]. The graft is more prone to injury in the early stages of ligamentization. At 3–4 months post-op, the graft strength is found to be 50% of its actual strength [28]. At this time, the muscles are weak and post-op rehabilitation protocol is waning [29].

Lysholm score average for ACLR is good. We are achieving good results within 6 months, and these are not significantly different from those at 1 year. These scores themselves provide testimony to a sound technique and postoperative rehab.

By reaching close to our peak Lysholm scores relatively early, we account for achieving better functional outcome and rapid increase in the thigh girth. We attribute this to avoiding post-op bracing and enhanced recovery protocol (Fig. 3).



Fig. 3 Postoperatively patient is mobilized full weight bearing without brace and stair climbing is initiated within 48 h after surgery

Conclusion

ACLR with early strengthening of quadriceps, patient education, and avoidance of post-op bracing is a viable method to prevent rerupture of hamstring grafts.

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Compliance with ethical standards

Conflict of interest The author declares that there is no conflict of interest.

Ethical standards All human and animal studies have been approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Specific national laws have been observed.

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