JKBMS, Vol.6, No.1, P.47-52, 2018

https://doi.org/10.56056/amj.2020.118

Bracing versus non-bracing after anterior cruciate ligament reconstruction surgery

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Abstract

Background and objectives: Anterior cruciate ligament reconstruction is a common procedure which can allow patients to return to their active lifestyle. Knee braces have been prescribed frequently to protect the anterior cruciate ligament graft after reconstruction. The aim of this study was to see the effect of postoperative bracing with non-bracing after one year follow-up. **Methods:** Thirty consecutive patients with a unilateral anterior cruciate ligament rupture were reconstructed. The first 15 patients were supplied postoperatively with a knee brace for 6 weeks. The next 15 patients were not supplied with a brace. The follow-up was based on the Lysholm functional score, Tegner activity level, manual Lachman test and pain by visual analog scale, each variable were recorded before surgery, 12 weeks, 24 weeks and one year after the surgery. **Results:** After one year follow up, the results of this study showed no statistically significant differences between the brace and non-brace groups with regard to Lysholm score (mean with brace was 87.26, without brace was 87.80), Tegner activity level (mean with brace was 6.26, without brace was 6.40) and manual Lachman test; however, the pain score was less with brace group in the short term follow up (at 12th postoperative week) but no statistically significant differences was found between the groups after 1 year follow up. **Conclusions:** Weather using functional brace or not after anterior cruciate ligament reconstruction depends on the orthopedic surgeon and the psychology and pain threshold of the patient.

Key words: Anterior cruciate ligament, Brace, Knee, Pain .

Introduction

The Anterior Cruciate Ligament (ACL) is the primary restraint to anterior tibial displacement, accounting for around 85% of the resistance to the anterior drawer test when the knee is at 90 degrees of flexion and neutral rotation[1].

Anterior Cruciate Ligament Reconstruction (ACL-R) is a common procedure which can allow patients to return to their active lifestyle. The surgical techniques, postoperative management and accelerated physiotherapy programs for patients following ACL-R have changed considerably over the last two decades[2].

Knee braces have been prescribed frequently over this period and used to assist individuals with ACL deficiency or to protect the ACL graft after ACL-R[3].

Anterior Cruciate Ligament tears result in altered tibiofemoral kinematics and joint contact mechanics, meniscal tears and osteoarthritis. Additionally, residual instability, neuromuscular deficits, and altered lower extremity biomechanics following ACL injury and reconstruction can result in overcompensation and altered biomechanics in the contralateral leg and an increased risk of secondary injury[4].

Functional brace use has been reported for Postoperative stabilization to theoretically allow normal tibiofemoral kinematics while preventing excessive strain and elongation of the healing ACL graft[5].

There is some controversy surrounding knee braces, as Feller et al [6] investigates. By wearing a knee brace for a prolonged length of time, this will certainly lead to quadriceps atrophy, and if the patient removes the brace, it may not be reapplied correctly. There is also a chance that the brace may cause pressure sores where it makes contact with the skin, and there is also the question of compliance of advised use, which along with the differences in postoperative instructions begs the question: are knee braces

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really necessary after ACL reconstruction?

Bracing after ACL reconstruction is put for patients habitually by many orthopedic surgeons and should be explored from several perspectives, as the clinical enquiry of its benefit is not absolutely straightforward.

The aim of this study was to compare the effect of postoperative bracing after ACL reconstruction with non-bracing after one year follow up with concern to pain (assessed by visual analogue score)[7], Lysholm score[8], Tegner activity level [9] and manual Lachman test[10].

Patients and methods

This is a prospective study of thirty consecutive patients with a unilateral chronic ACL rupture reconstructed between May 2017 and April 2018 by using an identical technique carried out in Erbil Teaching Hospital in Erbil city. The first 15 patients (group A) had knee brace applied for six weeks. The next 15 patients (group B) followed the same rehabilitation protocol except that they were not supplied with a brace, the follow-up was performed for one year which lasted until April 2019. The follow-up examination was based on the Lysholm subjective functional score [8], Tegner activity level [9] , and manual Lachman test [10] to evaluate the anterior laxity of the knee and pain by Visual Analog Scale (VAS)[7], each variable recorded before surgery, 12 weeks, 24 weeks and one year after surgery. All the subjective scores were patient administered.

The Tegner activity level score is a one-item score that grades activity based on work and sports activities on a scale of 0 to 10. Zero represents disability because of knee problems and 10 represents national or international level soccer [11]. The Lysholm score consists of 8 items. It is scored till 100 (<65=poor, 65-83=fair, 84-90=good, >90=excellent), with higher scores indicating fewer symptoms and higher levels of functioning. The Visual Analog Scale (VAS) is a validated, subjective measure for acute and chronic pain. Scores are recorded by making a handwritten mark on a 10-cm line that represents a continuum between “no pain” and “worst pain” [7]. Clinical tests commonly used to assess anterior cruciate ligament function and integrity includes the anterior drawer, the pivot shift and the Lachman tests. Magnetic resonance imaging also used for the diagnosis which is usually the preferred radiological investigation to confirm the diagnosis.

All the patients were operated on by the same arthroscopic surgeon, using a standardized technique, by taking hamstring tendons autograft from the ipsilateral knee. All associated meniscal injuries were addressed at the time of the index operation. All patients were rehabilitated following a standard protocol. Early weight-bearing was encouraged. Closed chain exercises were started during the [1]st postoperative week. Running was permitted after 3 months and contact sports after 6 months.

The patients in group A had brace which was locked in full extension for the first 2 weeks, then 90 degree of motion was allowed with the brace for another 2 weeks ,then full range of motion with brace still applied to the knee, then removed at 6 weeks postoperatively.

The patients in group B, on the other hand, had no brace; both groups underwent the same rehabilitation protocols.

Data was recorded on a specially designed questionnaire, collected and entered in the computer, then analyzed using appropriate data system called Statistical Package for Social Sciences (SPSS), version 25, and the results compared between patients with different variables, with a statistical significant level of p-value of ≤ 0.05.

The results presented as rates, frequencies, percentages in tables and analyzed using Chi square and T-tests.

This study was submitted to the scientific and research ethics committees of the Kurdistan Board of Medical Specialties for scientific and ethical approval. This study was explained for each patient and consent was obtained from each of them. Confidentiality of data was ensured too.

Results

A total of 30 patients enrolled in the study, 26 of them were male. The male: female ratio was 6.5:1, the mean age ± S.D of patients with brace was 28.73 ± 4.26 years and that of participants without brace was 29.20 ± 5.05 years.

The data of Table 1 indicate that the average Lysholm scores for patients with and without brace were very close to each other, thus there was no statistically significant difference between those groups during 12 weeks and one year follow ups. In contrary, at 24 weeks of follow up the mean Lysholm score of participants with brace was 86.06

while that of patients without brace was 87.66, and this difference was statistically significant with p-value of 0.02, but still both groups are within the same grade (good which is between 84 and 90).

Table (1): Follow up of participants by Lysholm score.

Follow up	Study group	Mean	S.D	p-value
12 weeks	With brace	85.13	2.74	0.85
	Without brace	85.33	3.30	
24 weeks	With brace	86.06	1.83	0.02
	Without brace	87.66	1.95	
One year	With brace	87.26	2.21	0.51
	Without brace	87.80	2.07	

According to Table 2 findings, there were no statistically significant differences in mean Tegner activity level between patients with and without brace during all follow up periods of 12, 24 weeks and 1 year. In all cases the p-values were more than 0.05.

Table (2): Follow up of patients with and without brace using Tegner activity level.

Variable	Study group	Mean	S.D	p-value
12 weeks	With brace	3.13	1.06	0.07
	Without brace	2.53	0.63	
24 weeks	With brace	4.80	0.67	0.06
	Without brace	4.33	0.61	
One year	With brace	6.26	0.45	0.45
	Without brace	6.40	0.50	

The results of Table 3 reveal a statistically significant difference in the mean pain experienced by the two groups after 12 weeks of surgery. Patients with brace had less average pain (1.80) in comparison to those without brace (2.53). While for the periods of 24 weeks and 1 year, there were no statistically significant differences in mean pain score between patients with and without brace.

Table (3): Follow up of study groups by Pain score during different timings.

Variable	Study group	Mean	S.D	p-value
12 weeks	With brace	1.80	0.56	0.001
	Without brace	2.53	0.51	
24 weeks	With brace	0.80	0.56	0.79
	Without brace	0.86	0.83	
One year	With brace	0.06	0.25	0.55
	Without brace	0.13	0.35	

The findings of Table 4 show that there was no statistically significant difference between study groups and manual Lachman test for the three follow up timings i.e. most of the patients whether with or without brace had negative test results after operation. Chi square test was done and p–values were more than 0.05.

Table (4): Comparison between with and without brace cases using Manual Lachman Test (MLT)

Follow up	Study group	Negative MLT	<5 mm anterior tibial translation	Total	p-value
12 weeks	Without brace	13	2	15	0.14
		86.7%	13.3%	100%	
	With brace	15	0	15	
		100%	0%	100%	
24 weeks	Without brace	11	4	15	0.66
		73.3%	26.7%	100%	
	With brace	12	3	15	
		80%	20%	100%	
One year	Without brace	9	6	15	0.23
		60%	40%	100%	
	With brace	12	3	15	
		80%	20%	100%	
Total		21	9	30	
		70%	30%	100%	

Discussion

The main factors in ACL reconstruction are the surgical procedure, the surgeon's experience, and the post¬operative rehabilitation program. Pro¬prioception, ROM, and strength might be improved by the appropriate rehabilitation program, and a possible negative effect can occur if we consider that a patient without a knee brace can repeat some exercises in a free program, while a patient with a brace loses this probable benefit. However, the provided primary stability of the graft/technique is not always ideal, and additional protection should be taken into account; moreover, we should consider that many patients do whatever they want without a strict rehabilitation program or safe supervision, as many professional athletes do.

Older surgical techniques used in the past to treat injuries of the ACL led to the development of a large number of functional braces. Today, with advances in surgical techniques and more aggressive rehabilitation treatment in the postoperative course, the usage of functional braces after ACL reconstruction is a controversial issue[12].

The use of a brace is widespread, because it is considered to have positive effects on joint stability and protects the graft by minimizing the stress forces across the knee. Nevertheless, disadvantages of bracing have been claimed, including the potential muscle atrophy, loss of knee extension at the removal, decreased patient's perception of maximal performance, increased fatigability during exercise, and additional costs. Unfortunately, no evidence exists on effectiveness of bracing in patients with ACL-R and concomitant surgery, and this issue needs to be confirmed by further research[13].

There are many variables to compare between the brace and non-brace groups after ACL-R surgery, such as different knee laxity tests, Range of Movement (ROM), pain, mid patellar knee circumference and knee scores. Each study will compare some of these variables. In our study, we choose pain (by VAS); from the knee laxity tests we choose the manual Lachman test, which is the most accurate with sensitivity of 85% and specificity of 94%[14]; and from the knee scores we compared the Lysholm functional score[8] and the Tegner activity level[9], which are patient administered scores to evaluate the function and activity of the patients.

The Tegner activity level was first described in 1985 and initially designed for physician administration after ACL and meniscal injuries[9]. To date, the Tegner activity score has been a frequently used patient-administered activity rating system for patients with various knee disorders [11].

The Lysholm score was initially designed for physician administration and was validated in patients with ACL in-

juries and meniscal injuries[8]. It has also been validated as a patient-administered instrument to measure symptoms and functions in daily activities in patients with a variety of knee injuries[11]. Rodríguez-Merchán[12] did an article review and found that several systematic reviews and other reports on the topic of knee bracing after anterior cruciate ligament reconstruction do not support the use of a postoperative brace after ACL reconstruction. postoperative bracing after ACL reconstruction does not appear to help pain, function, rehabilitation, and stability. There is insufficient evidence to inform current practice. Good-quality trials on the subject are warranted.

However, according to Smith et al[4], literature and research results did not discover any significant benefit of brace after ACL-R, as this has never obviously been demonstrated. Although Bordes et al[15] concludes that there is no statistically significant difference regarding early or late pain postoperatively in both brace and non-brace groups after ACL-R, our results about the pain is similar to that of Brandsson et al[16] who reported significantly higher levels of pain in the non-brace group (mean VAS score 2.3 range 0-9) compared with the brace group (mean VAS 1.0, range 0-7) during the first two weeks postoperatively.

Our results for the Lysholm score, Tegner activity level and manual Lachman test are consistent with McDevitt et al 5 and most of the studies like Bordes et al[15], Birmingham et al[17] and Harilainen, 18 which showed the same results about these variables of no significant differences for postoperative braced and non-braced groups after ACL-R. In one group of population that brace wear has been reinforced in the literature is in skiers. A retrospective study of skiers who had previous ACL reconstruction, found less recurrent knee injuries requiring operation in the braced group[19]. Another study demonstrated that the brace group reached full extension in the early postoperative period more frequently[20].

Rebel[21] concluded that the benefits of the knee brace were due to the mechanical action, an enhanced coordination, and a psychological effect.

A study about recommendation for bracing for ACL concluded that the decision of whether to brace a patient after ACL reconstruction remains one that belongs to the physician in the background of each individual patient and the goals of treatment. The importance of bracing may be psychological. If a patient requires the psychological support of a functional brace as he or she returns to sport, it may be suitable in the setting of adequate patient counseling on the lack of a medical indication and the evidence for decreased physical performance in a brace[22].

Compliance when wearing the brace can also be questioned. Smith et al[4] stated that patients in the braced groups may struggle to ensure that they wear the brace for the recommended time, not have the brace in the correct position or tight enough to support the knee. If the brace is not in the correct position, then the patient is at risk of over flexing or extending the operated knee. The patient is also at risk of pressure sores if the brace is rubbing in a particular area if put on the knee incorrectly.

In their study, Di Miceli et al[13] concluded that data in their study evidenced a better midterm functional outcome when patients with isolated ACL-R were not immobilized with a knee brace after surgery and had full weight bearing in six weeks after surgery.

Given the generally high surgical success rates, there has been no scientific evidence so far to support the routine use of a functional knee brace following a successful ACL reconstruction in the controlled rehabilitative postoperative course[23].

The strengths of this study include the standardization of the surgical technique, rehabilitation program and the patient-administered subjective functional scores. All the surgical parameters were well checked, and there were no drop-outs.

Consecutive patients with unilateral chronic ACL insufficiency were included, and brace was used in the first 15 patients. A randomized procedure would have increased the statistical strength of the study still further, but unfortunately, this was not possible for practical reasons. We can regard this as limitation in the study.

Another limitation of our study is the short follow-up, which did not allow us to evaluate the long-term consequences of wearing or not wearing a brace during the initial rehabilitation phase. However, published studies show similar clinical outcomes between patients who wear a rigid brace, articulated brace or no brace in the long-term[24].

Conclusions

Weather using brace or not after ACL-R depends on the surgeon and the pain threshold of the patient, because after 1 year follow up, the results of this study showed no statistically significant differences between the brace and non-brace group with regard to Lysholm score, Tegner activity level and manual Lachman test, except the pain which was less with brace group in the short term follow up (at 12th postoperative week). So, we don't recommend the use of brace after ACL reconstruction, but it depend on the orthopedic surgeons' viewpoint. The orthopedic surgeon can use postoperative brace for psychological support for the patients and in order to use less analgesic drugs for patients that don't tolerate pain a lot..

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