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Comparison between Immediate and Delayed Weight Bearing in Arthroscopically Assisted Anterior Cruciate Ligament Reconstruction

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ABSTRACT

Background: Anterior cruciate ligament (ACL) rupture is one of the most frequent orthopedic sports traumas. The treatment of choice for an ACL tear is ACL reconstruction and usually followed by 4-9 months of outpatient sports or orthopedic physical therapy. There are different exercises and regime variations in rehabilitation after surgery. Both weight-bearing and non-weight bearing exercises have been used and shown to be effective for rehabilitation in post ACL reconstruction and return to sport.
Objectives: To compare the effect of immediate and delayed weight-bearing in a rehabilitation protocol after ACL reconstruction.
Materials and methods: Forty patients with an ACL injury with or without meniscal injury were included in the study. They divided into two groups, group A with immediate weight-bearing and group B delayed weight-bearing after surgery and we followed them with lysholm score and took results before surgery, after 3 months, and after 6 months from surgery.
Results: Results of the mean value of lysholm score before surgery group A 65.40 and group B 66.90 with P-value 0.421, after 3 months group A 81.55 and group B 81.75 with P-value 0.904 and after 6 months from surgery group A 91.65 and group B 92.25 with P-value 0.675.
Conclusion: There is no functional difference between immediate weight-bearing and delayed weight-bearing after ACL reconstruction. Clinically immediate weight-bearing better than delayed weight-bearing by improving muscle performance around the hip and knee and improve the condition of the cartilage, immediate weight-bearing not harmful on the knee joint or ACL graft.

Keywords: ACL reconstruction; Immediate weight-bearing; Arthroscopy; Delayed weight-bearing.

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INTRODUCTION

The knee is the largest and most complex joint in the human body and is highly prone to injury [1]. ACL rupture is common orthopedic sports injuries, with a yearly incidence of 35/100000 people [2]. Injuries to the ACL are a common abnormality in the orthopedic field with an incidence of about 200000 cases/year in the United States [3]. Non-contact deceleration, like sudden stopping or changes in direction, is the classical mechanism of an ACL tear. It is usually accompanied with a meniscal and articular cartilage tear [4, 5]. Despite the symptoms of the deficient knee is poorly defined, prior studies have reported that an individual with an ACL deficient knee complains from pain, features of knee joint instability and inability to do sports activities properly. As a result of the ACL tear, chronic instability of the knee, progressive chondral and meniscal damage, osteoarthritic changes and poor quality of life will be recognized complications [6].

In about 1/3rd of patients with ACL injuries due to direct contact, there is often a history of valgus stress or hyperextension of the knee resulting frequently in a pop, which heard, and/or felt. Usually, knee swelling appears 4 hours following trauma and reveals blood on joint aspiration [7].

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It is easy to diagnose an ACL tear through clinical evaluation if it is done before knee swelling, muscle guarding and pain appears. The Lachman test is usually used in the assessment of anterior translation of the tibia [8, 9]. The arthroscope is the gold standard technique for diagnosing ACL tears, followed by magnetic resonance imaging (MRI) with a specicity of 95% and a sensitivity of 86% in diagnosing such tears. Both bundles of the ACL can be showed using MRI [10, 11].

If the ACL tears associated with other knee structures, including the lateral, medial, and posterior collateral ligament or menisci, operative reconstruction is of utmost importance [12, 13]. However, conservative management is indicated in those individuals with less activity, minimal clinical features, unwanted or unable to follow the post-reconstruction regimen of rehabilitation [14, 15]. It approved that the outcome of the patients who use weight-bearing exercises in comparison with non-weight bearing exercises, in their physiotherapy regimen is better regarding the pain and stability of the knees, and they are happier with the result, and return early to their sport [16]. The usual rehabilitation (sports or orthopedic physiotherapy) period comprises of 4−9 months as an outpatient. The physiotherapy aims to resolve certain complications like pain, swelling, and limited range of mobility, and to restore muscle strength and dynamic stability without disturbing the healing of the graft [17, 18]. Quadriceps strengthening exercises to achieve full knee extension, no knee extension lag with an improvement in the quadriceps index (involved-side quadriceps strength/uninvolved-side quadriceps strength) to more than 90% before reconstruction [19, 20].

The objective of the study was to compare the effect of immediate weight-bearing versus delayed weight-bearing as a part of a rehabilitation program on the functional outcome of the knee after ACL operative reconstruction.

MATERIALS AND METHODS

A Prospective comparative randomized study on 40 subjects complaining from an ACL tear with or without meniscal injury during the period from June 2015 to December 2016, at Baghdad Medical City Complex in a follow-up duration for 6 months after surgery for each patient.

All patients were divided into 2 groups randomly one alternative to other, group A with immediate and group B with delayed weight-bearing following ACL reconstruction.

The inclusion criteria for patients sample are age between 20 to 40 years old and ACL injury with or without meniscal injury. Exclusion criteria include chondral lesions, age below 20 or above 40 years, osteoarthritic changes in the knee, any associated other ligament injuries in the knee and any deformity in the lower limb.

All patients from both groups were examined at the consultation room and Lachman test and anterior drawer test were positive and plain X-Ray and MRI of the knee was done to them to establish the diagnosis. The time of presentation of patients to surgery was about 2 months to 18 months from the onset of the injury. Verbal and informed consent was taken from patients for acceptance to participate in this study.

Group A composed of 20 patients with 19 males and 1 female with a mean age group of 32 years and mean presentation time from onset of injury to the time of surgery 10 months. While group B composed of 20 patients with 18 males and 2 females with mean age group 30 years and mean presentation time from onset of injury to the time of surgery 9 months.

All patients from group A and group B underwent arthroscopic ACL reconstruction and partial meniscectomy for patients with meniscal injuries. Preoperative preparation was done 1 day before surgery. Prophylactic antibiotics administered 1 hour before surgery. All patients were given either general, spinal or epidural anesthesia and ACL reconstruction surgery was done to them by the same surgeon and as follow, patient in supine position, pneumatic tourniquet applied then proper positioning of the knee done to permit flexion to 130 degrees, diagnostic arthroscopy done unless clear diagnosis of ACL injury clinically proved and treatment of meniscal injury if present. Then harvesting gracillis, and semitendinosus done and then preparation of tendon graft and kept in moist gauze, preparation of femoral tunnel by femoral guidewire and drilling done, then preparation of tibial tunnel by tibial jig and tibial guide wire and drilling done, then fixation of the tendon graft by 2 interference biodegradable screws then testing the strength of fixation by pre-tensioning with cycling loading then closure of skin and splint the knee. All patients received prophylactic antibiotics 24 hours postoperatively and analgesics and applying a static knee brace after surgery.

All patients were followed every 2 weeks at outpatient department and instructed to do rehabilitation and home exercise as follow: At the 1^{st}-week foot and ankle exercises and quadriceps exercises, at the end of 1^{st}-week patient allow to do 30-degree flexion then return of brace, with assisted crutches walking. At the 2^{nd}-week the same as a 1^{st}-week but at the end of the week, the patient encourages to do knee flexion 45 degrees and return the brace. At 3^{rd}-week quadriceps exercises and flexion of the knee to 90 degrees and return the brace. At 4^{th}-week the same exercises as mentioned above and knee flexion to 120 degrees for 5 minutes 3 times a day and bicycling exercises in the air as the patient lying supine and raising the legs. At 5^{th}-week continue the same exercises above with more knee flexion beyond 120 degrees and leaving the crutches at the end of the week after assessment of the patient. At 6^{th}-week week full range of motion exercises with the removal of a knee brace and do squatting with assistance and continue on quadriceps exercises. At 3 months patient begin with squatting position and jogging program. At 6 months patient return to sports activity after assessment. The patients in group A and B sustain the same postoperative care and rehabilitation except that in group A patient immediate weight-bearing within 24 hours after surgery permitted as patient tolerance and within the pain limit. Patients with group B permitted delayed weight-bearing (after 2 weeks from the operation). All patients from group A and group B assessed using lysholm scoring questionnaire with an estimation of the functional knee outcome preoperative, and 3, 6 months postoperative.

The study was approved by the ethical committee of Baghdad Medical City Complex. The data were analyzed using IBM SPSS Statistics version 20. P-value <0.05 is considered significant.

RESULTS

Group A included 15 patients presented with ACL and meniscal injury and 5 patients presented with an isolated ACL injury. Group B included 14 patients presented with ACL and meniscal injury and 6 patients presented with an isolated ACL injury. Results of lysholm score of group A and group B preoperative, after 3 months, and after 6 months from surgery shown in Table 1 and Table 2 respectively.

Mean value of lysholm score of group A and B: Before

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Table 1. Results of lysholm knee scoring scale of group A patients with immediate weight-bearing including before, after 3 months, and after 6 months from ACL reconstruction surgery.

Group A	Before surgery	After 3 months	After 6 months
1	59	84	95
2	57	70	94
3	65	87	97
4	68	84	93
5	68	85	96
6	76	82	84
7	60	88	95
8	57	87	92
9	73	75	90
10	53	69	84
11	58	67	82
12	66	82	94
13	65	88	96
14	70	87	93
15	65	80	90
16	66	82	94
17	70	84	90
18	67	80	92
19	72	84	90
20	73	86	92

Table 2. Results of lysholm knee scoring scale of group B patients with delayed weight-bearing including before, after 3 months, and after 6 months from ACL reconstruction surgery.

Group B	Before surgery	After 3 months	After 6 months
1	73	80	93
2	64	82	84
3	67	80	96
4	60	78	84
5	67	86	96
6	72	82	94
7	65	88	97
8	72	84	95
9	68	80	93
10	70	78	95
11	69	77	96
12	66	80	95
13	64	76	96
14	71	88	94
15	65	82	93
16	62	78	82
17	78	88	96
18	70	84	92
19	60	82	90
20	55	82	84

surgery, group A 65.40 and group B 66.90 with no statistically significant difference (p-value 0.421). After 3 months: mean of group A lysholm scoring is 81.55 and mean of group B lysholm scoring is 81.75 with no statistically significant difference (p-value 0.904). After 6 months of surgery: mean of group A lysholm scoring is 91.65 and mean of group B lysholm scoring is 92.25 with no statistically significant difference (p-value 0.675) Table 3 and Figure 1.

Table 3. Comparison between results of lysholm scoring scale of group A and group B after 6 months from surgery.

Tegner Knee Scale	Lysholm Scoring	Number	Mean (%)	Std. Deviation	Std. Error	T-test P-value
After 6 months Surgery	Group A	20	91.65	4.171	0.933	P=0.675
	Group B	20	92.25	4.800	1.073	Non-sign
	Total	40				P>0.05

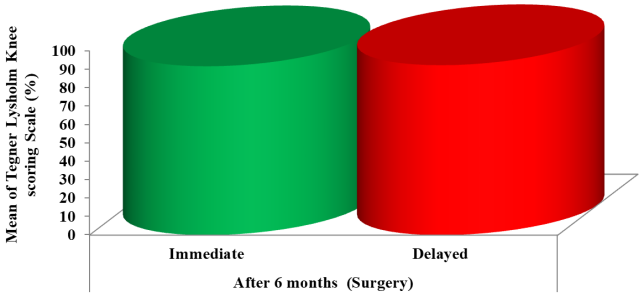

Figure 1. Cylinder bar chart of comparison between results of lysholm scoring scale of group A and group B after 6 months from surgery.

DISCUSSION

In this study male more than females in the research sample, this explained partially because of community habits and females not allowing participating sports activities like males.

The results in the current study reflect that there is no statistical difference between immediate weight-bearing rehabilitation and delayed weight-bearing rehabilitation. The lysholm score and Cincinnati score are the most valid and most widely used between outcome scales in clinical evaluation and scientific researches [21, 22] and there are also many studies which result in reality of lysholm score in functional assessment of the knee after ACL injury and reconstruction [16, 23]. There is no statistically significant difference between the subjective assessment (by IKDC and lysholm score) and the one leg hope test [22] so the current study depending on lysholm score for evaluation of the functional status of the knee after ACL reconstruction and progression of improvement during the estimated time of research. Kruse et al said that Most of the researches in the last two decades reflect that ACL rehabilitation protocol based widely on 6 months' time duration before return to sport [24].

There is controversy on the effect of early aggressive rehabilitation protocol with no limitation of movement and immediate weight-bearing on semi tendinosis gracilis graft but there are many studies prove the validity of this regimen on bone-patellar tendon-bone graft [15].

West et al, Wright et al, and Naud et al support the use of early aggressive rehabilitation protocol with immediate weight-bearing for 0 to 90 degree of knee flexion with closed kinetic chain exercises on semi tendinosis gracilis graft and improve its effectiveness and safety especially there is improvement in fixation techniques and there are no side effects regarding future graft injury rate or damage, ROM, AP laxity of knee joint and return to sport [15, 24] also there is no harm on the stability and function of knee joint when the pa-

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tient allowed to immediately weight-bearing after operation of ACL reconstruction.

Benefits of immediate weight-bearing include decreasing the joint effusion after operation and movement of all muscles around knee, also the weight-bearing compressive effect increase the nutrition of articular cartilage, improve the joint congruity and increase the mineral density of the subchondral bone which is low before the surgery, increase the mineral density of the bone near the knee joint is important for graft healing in the tibial tunnel and femoral tunnel so the patient starting impacted loads during rehabilitation which encourage the stimulation which is needed for osteogenesis process and also weight-bearing protocol improves the functions of muscles around the hip (external rotators, abductors, and hip extensors) and muscles around knee which improve the knee proprioception [17].

The load on ACL graft is more in non-weight bearing exercises than weight-bearing exercises, the load more between 10 to 50 degree of knee flexion and weight-bearing decrease the translation of tibia in relation to the femur by the counteracting muscles around knee so decrease the strain on the graft [20]. There is no functional difference between group A (immediate weight-bearing) and group B (delayed weight-bearing).

The current study showed that the immediate weight-bearing in a rehabilitation protocol after ACL reconstruction was not harmful and has no adverse effect on the functional outcome of the knee witch coincide with Christensen et al, Paulos et al, Johnson et al and Tyler et al [15, 17].

CONCLUSION

There is no functional difference between immediate and delayed weight-bearing after ACL reconstruction. However, clinically immediate weight-bearing better than delayed weight-bearing by improving muscle performance around the hip and knee and improve the condition of the cartilage. We advise immediate weight-bearing after ACL reconstructions.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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