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Research article

A Prospective Comparison of Two-strand and Four-strand Hamstring Tendon Outcomes in Patients with Arthroscopic Reconstruction of the Anterior Cruciate Ligament referred to Imam Khomeini Hospital during 2013 to 2016

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ABSTRACT

Objective: This prospective study compared the outcomesof two approaches for anterior cruciate ligament (ACL) reconstruction including two-strand semitendinosus versus four-strand semitendinosus-gracilis graft.

Methods: Forty patients with anterior cruciate ligament rupture were evaluated during 3 years (2013-2016). The patients were divided in two group (n= 20). The evaluated parameters were time of return to previous daily activities, time of return to previous sport activities,the number of physical therapy sessions after surgery, postoperative complications, Lysholm questionnaire score.

Results:There were no statistical significance difference in the obtain results of the evaluation parameters of two groups. Only in Lysholm scores, the mean score of Lysholm index in 4-strand hamstring group was 90.75 (excellent) and in 2-srand hamstring group was 89.65 (good) that there were clinical significance differencebetween two groups in functional outcomes.

Conclusion: According to the similarity of results of two groups, it can declare the equal superiority of both 2-strand semitendinosus and 4-strand semitendinosus-gracilis graft method and both methods are suggested for ACL reconstruction.

Keywords: Hamstring, Lysholm score, anterior cruciate ligament reconstruction

INTRODUCTION

Anterior cruciate ligament (ACL) has an important role in knee function(1). The injury of this ligament is the knee injury that causes significant disability in people, especially in athletes. Therapeutic strategies for patients with this injury included conservative restoration and reconstruction in various ways(2). Anterior cruciate ligament reconstruction causes the return of the patient to physical activity and delays in the onset of osteoarthritis, which is associated with the loss of meniscus function(3-5). Although cruciate ligament reconstruction surgery can also be performed by incising the knee skin and opening up the knee joint, but nowadays, the surgery is mostly performed by arthroscopy procedure. Although the possibility of the incidence of complications in this surgical procedure is low and if it is performed correctly it will be successful in about 90% of the cases but in case of the incidence, it could cause difficulties for the patient(6, 7). The most important of these complications are the infection at the site of surgery and/or blood clotting in deep veins of the leg. Also the limited mobility of the knee joint

could be caused by technical problems during surgery and/or lack of therapeutic exercises after the surgery. Knee pain, patellar ligament rupture and instability could also be other possible complications(8, 9). Nowadays, there is little disagreement over the importance of ACL reconstruction after rupture or lower inefficiency, and the case of discussion is the reconstruction techniques and the type of graft used. Due to the disappointing results of ACL reconstruction and restoration, different ACL reconstruction techniques have been presented in various sources, where grafts such as bone-patella tendon-bone, hamstring tendon, quadriceps femori muscle, Allograft and synthetic material are used to replace the ACL that each one has its own advantages and disadvantages(10-12).Although numerous studies have been published with regard to the results of anterior cruciate ligament reconstruction, the results reported do not significantly show the superiority of one procedure over other procedures. The aim of this study is to compare the functional results of arthroscopic ACL reconstruction of the two arthroscopic surgical procedures of using four-strand semitendinosus-gracilis (hamstring) grafts and two-strand semitendinosus (hamstring) grafts.

MATERIALS AND METHODS

This study was a randomized prospective study that was conducted between 2013 and 2016 on patients with anterior cruciate ligament rupture referred to Ahvaz Imam Khomeini hospital. The patients had undergone surgery using one of the two methods of arthroscopic using four-strand semitendinosus-gracilis (hamstring) grafts or two-strand semitendinosus grafts. For the patients in four-strand hamstring group, the second graft (gracilis) was harvested if the diameter of the first graft (semitendinosus) was less than 6-8 mm, unless we used only 2-strand semitendinosus hamstring grafts.Patients with a previous knee injury or prior knee surgery, simultaneous fractures, osteoarthritis and/or serious injury to other ligaments including the posterior cruciate ligament, lateral collateral ligament, medial collateral ligament and posterolateral corner, were excluded from the study. Considering the inclusion and exclusion criteria of the study, eventually, 20 patients (age category of 17-40) were enrolled for each group of surgical procedure. All reconstructions were performed by one orthopedic surgeon. Patients underwent physical therapy prior to surgery, in order to reduce inflation and restore the range of motion. Knee function was measured through the person's ability to bear weight, difficulty in climbing stairs, ability to run and difficulty in squatting. Postoperative complications including deep infectionand wound infectionwere recorded. The clinical and functional outcomes of the patients after reconstruction surgery by the two graft methods applied were evaluated over time with regard to the sense of stability, pain, inflation, the ability to perform routine and sports activities, and further rupture. Also, the standard Lysholm questionnaire was used for both groups (Table 1). The postoperative rehabilitation procedure was similar for all patients. Eventually the data from the evaluations and the differences in the aforementioned parameters were statistically analyzed using SPSS software. The level of significance was assumed 0.5.

Table 1. Grading the TegnerLysholm Knee Scoring Scale

Grade	Score
Poor	<65
Fair	65-83
Good	84-90
Excellent	>90

RESULTS

This study aimed to compare two surgical methods includes four-strand semitendinosus-gracilis grafts and two-strand semitendinosus grafts in anterior cruciate ligament replacement. Forty patients with ruptured ACL that underwent surgery with one of the two mentioned methods are divided into two groups equally (n=20). Outcomes of patients were evaluated under clinical and functional assessments. All statistical analysis was performed with SPSS20 software and significant level was considered $P< 0.05$.

The patients in four-strand and two-strand hamstring group were introduced ST+GR and ST in the statistical evaluation respectively.

The average age of patients in ST group was 33.75±5.34 years and in ST+GR group was 32.10±7.907 years. There was no statistically significant difference (P= 0.44) and the mean age of the two groups were homogeneous.

Rehabilitation program of all patients were similar before surgery.The number sessions of physical therapy after surgery that patients needed to achieve partial recovery for all patients in both groups were compared with each other.

The average number of physical therapy sessions after surgery in ST group was 24.20±4.112 and in ST+GR group was 22.45±6.747 that there was no statistically significant difference (P= 0.328) (Figure 1).

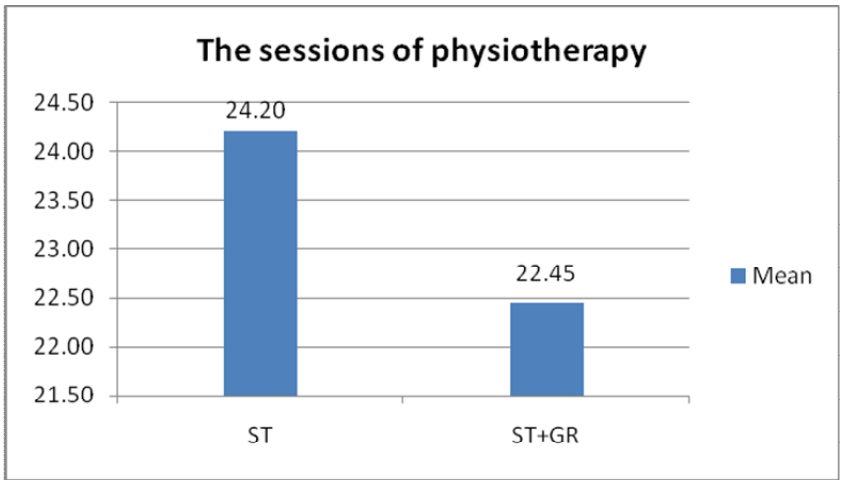

Figure 1. The average number of physical therapy sessions after surgery in two groups

The time of require to return to daily activities after surgery were evaluated in the patients in term of month. The average time of require to return to daily activities after surgery in ST group was 2.125±0.559 months and in ST+GR group was 1.950±0.456 months that there was no statistically significant difference (P= 0.285) (Figure 2).

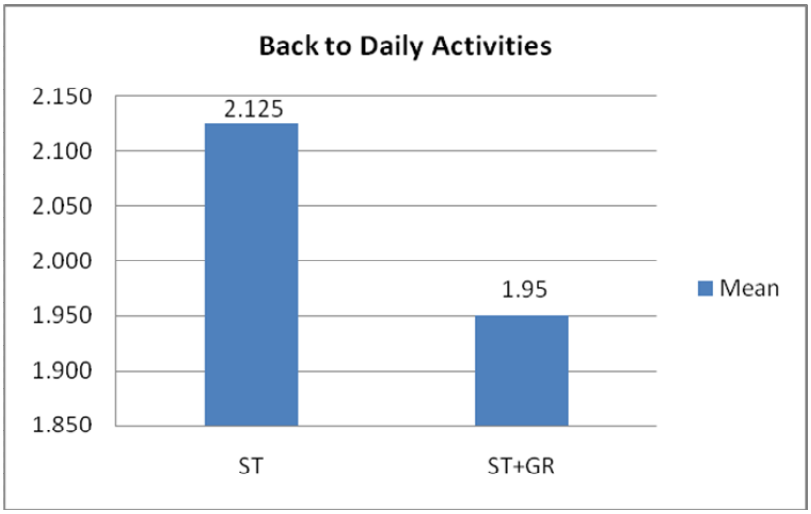

Figure 2. The average time of require to return to daily activities after surgery in two groups

The evaluated patients in this study were ordinary people and they were not professional athletes.

Therefore, in this study the parameters of sport activities were assessment based on the ability to run without pain, fast walking and heavy activities.

The average time to return to sport activities after surgery in ST group was 3.925±0.977 months and in ST+GR group was 3.825±0.907 months that there was no statistically significant difference (P= 0.739) (Figure 3).

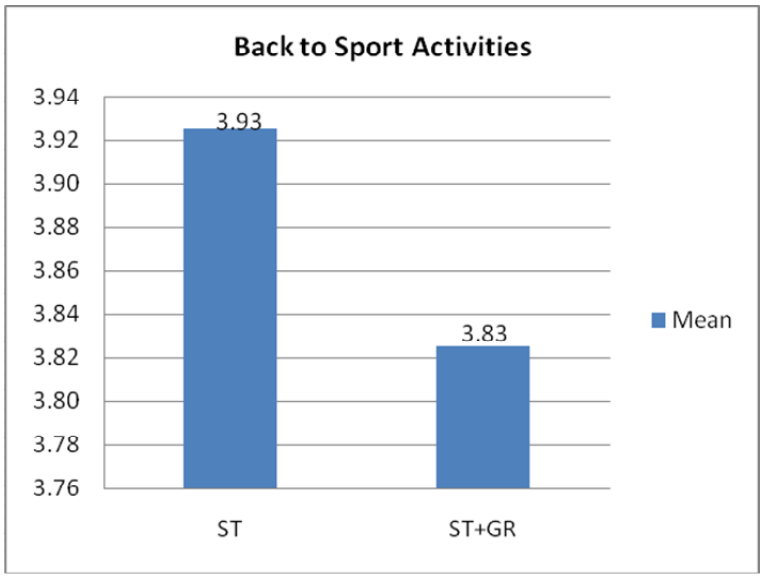

Figure 3. The average time to return to sport activities after surgery in two groups

The Lysholm questionnaire was completed for all patients. The average score of Lysholm questionnaire in ST group was 89.65±7.576 that this score sets to good grade in Lysholm index. In additional the average score of Lysholm questionnaire in ST+GR group was 90.75±4.745 that this score sets to excellent grade in Lysholm index. There was no statistical significant difference between the average score of Lysholm questionnaire in two groups (P= 0.585), but based on grading of the TegnerLysholm knee scoring scale, there was clinical difference between functional outcomes of two groups (excellent versus good).

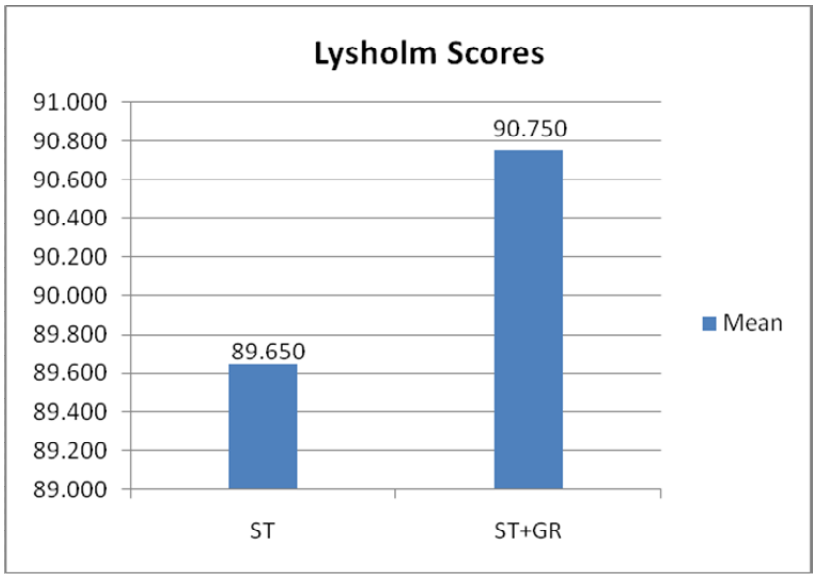

Figure 4. The average score of Lysholm questionnaire in two groups

The postoperative complications were evaluated in the patients of both groups.
In ST group, one patient complained about of weakness and one patient complained about instability while running. In ST+GR group one patient complained about of weakness, one patient complained of pain while

sitting, one patient complained about some activities such as descending of stairs and one patient complained about instability while scud.

None of the patients had another surgery or second reconstruction surgery in both groups.

Table 2. Complications of surgery in two groups

Group	Complications	Patients (n)
ST+GR group	weakness	1
	pain while sitting	1
	some activities	1
	instability while scud	1
ST group	weakness	1
	instability while running	1

DISCUSSION

The present study was a prospective clinical trial that they were evaluated outcomes of two surgical methods includes four-strand semitendinosus-gracilis (hamstring) grafts and two-strand semitendinosus (hamstring) grafts in patients with rupture of anterior cruciate ligament. The patients of two groups were evaluated and compared based on the time of return to daily activities, the time of return to sport activities, the number of physical therapy sessions after surgery, score of Lysholm questionnaire, the incidence of infection, need to second reconstruction surgery and Complications after surgery. Among recent studies about ACL reconstruction, the similar study with present research has not been designed so far. But several studies evaluated and compared outcomes of one of these surgical methods with other surgical methods for ACL reconstruction.

Beynnon et al. (2002) in a prospective, randomized and controlled study evaluated and compared the results of clinical testing, patient satisfaction, activity level, functional status, and muscle strength in replacement of a torn anterior cruciate ligament with either a bone-patellar tendon-bone autograft or a two-strand semitendinosus-gracilisautograft. Patients were followed for an average of 39 months (range, 36 to 57 months). After 3 years of follow-up, knee laxity, pivot-shift grade, and strength of the knee flexor muscles in bone-patellar tendon-bone autograft group were superior to those of replacement with a two-strand semitendinosus-gracilis graft. However, patient satisfaction, activity level, and knee function results had comparable in the two groups (13). The advantage of Beynnon et al. research on present study was the long-term follow up in 3 years. The results on their study have suggested that both of two surgical methods were appropriated for ACL reconstruction.

Aune et al. (2001) in a randomized study evaluated and compared the outcomes of four-strand gracilis and semitendinosus tendon and patellar tendon-bone in patients with subacute or chronic rupture of the anterior cruciate ligament. The follow-up was performed after 6, 12, and 24 months. The hamstring tendon group showed better the subjective result, single-legged hop test result and isokinetic knee extension strength after 12 months but no differences were found after 24 months. In addition, the hamstring tendon group showed a significant weakness in isokinetic knee flexion strength. Cincinnati functional score, KT-1000 arthrometer measurements and anterior knee pain were not significantly different between the groups (14). The results of study of Aune et al. were similar with the outcomes of four-strand hamstring tendon autograft in the present study. The time of return to daily and sport activities was achieved less than 6 months. Required time for functional and clinical healing was obtained in the first few months after surgery that this is the advantage of this surgical procedure.

Pinczewski et al. (2009) in a prospective and no control study compared the 10-year outcomes of ACL reconstruction using 4-strand hamstring tendon and patellar tendon autografts. Harvest-site symptoms, kneeling pain, radiographic osteoarthritis and pain with strenuous activities were more common in patellar tendon group. They recommended hamstring reconstructions

because of decreased harvest-site symptoms and radiographic osteoarthritis (15).

The advantage of Pinczewski et al. study on present research was the long-term follow up in 10 years. The functional outcomes of hamstring group in their study were excellent and similar to functional results of ST+GR group in our study. This method with less number of ACL rupture and pain has relative superiority to other treatment methods such as the patellar tendon.

CONCLUSION

According to the obtain results of functional and clinical evaluation and considering the similarity of results of patients in two groups, it can declare the equal superiority of both 2-strand and 4-strand hamstring tendon method and both methods are suggested for ACL reconstruction.

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