Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i18.3464

OUTCOME OF ALL-INSIDE ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Ali Torkaman[1], Omid Elahifar[2], Mohammadmahdi Omidian[3], Mohsen Fathi[4] Parsa Torkaman[5]*, Javad Ahmadloo[6]*

[1,2,4]Department of Orthopedics, School of Medicine, Iran University of Medical Sciences, Tehran, Iran
[3]Department of Orthopedics and Trauma Surgery, Faculty of Medicine, Shahid Beheshti University of Medical Sciences, Tehran Iran
[5*]Medical Student, Faculty of Medicine, Shahid Beheshti University of Medical Sciences, Tehran Iran
[6*]MD, 520 Regional Army Hospital, Kermanshah, Iran

***Corresponding author:** Parsa Torkaman and Javad Ahmadloo,
*Medical Student, Faculty of Medicine, Shahid Beheshti University of Medical Sciences, Tehran Iran MD, 520 Regional Army Hospital, Kermanshah, Iran, Email: parsatorkaman@gmail.com and jahmadloo491@gmail.com

Abstract

Introduction: The role of All-inside ACL reconstruction surgery in the treatment of ACL rupture has not been well defined and there is no comprehensive agreement on the various aspects of this surgery. In the present study, the outcomes and complications of ACL reconstruction surgery using the All-inside technique were investigated in a group of patients with ACL tears.

Materials and Methods: In a prospective study, 50 patients with ACL tears who underwent ACL reconstruction with the All-inside method were included in the study. The graft required for this operation was removed from the individual's own tendinosus muscle. The results of the Lachmant test, pivot shift test, were compared before and after the surgery. International Knee Documentation Committee (IKDC) and Lysholm score were employed to evaluate knee function 12 months after surgery. Quantitative comparison of side-to-side anterior tibial translation difference was done using KT-1000 arthromotor.

Results: The study population consisted of 43 men (86%) and 7 women (14%) with an average age of 28.9 ± 9.6 years. Lachmant test and Pivot shift test improved significantly after surgery ($P<0.05$. The average IKDC of the patients was 96.1±7.1, ranging from 70 to100. According to the Lysholm scale evaluated 88% patients (44 cases) as excellent, 6% (3 cases) as good, and 6% (3 cases) as fair. The mean difference of side-to-side anterior tibial translation was determined as 1.1±1 mm. A significant correlation was found between IKDC scores of patients and the number of physiotherapy sessions ($r=0.504$, $P<0.001$). No case of graft failure was found in this study.

Conclusion: All-inside ACL reconstruction surgery led to a significant improvement in the objective and subjective scales of patients with very few complications.

Keywords: ACL reconstruction, All-inside, Rupture.

Introduction

The anterior cruciate ligament (ACL) is one of the most important stabilizing structures of the knee and is very vital for the stability of the knee joint during running and sports activities. Rupture of the ACL is the most common knee trauma (1, 2) during sports and mainly caused by a sudden decrease in speed while running, and sports injuries with a rotational force on the knee (3).
ACL consists of two bundles, namely the anteromedial and posterolateral. The anteromedial bundle tightens during flexion and relaxes during extension, while the posterolateral bundle is tight in extension. The main role of the ACL is to prevent the tibia from sliding forward too much (4). Due to the importance of ACL in maintaining knee stability, ACL reconstruction technique s have evolved significantly over the years. The All-inside reconstruction technique was introduced about 20 years ago as an alternative to the classical reconstruction method. The All-inside method has significant features compared to the standard ACL reconstruction technique (5).

In the All-inside technique, a three-layer or four-layer autograft tendon is generally employed. While in the classic method, Patellar Tendon Bone or Semitendinosus-Gracilis Tendon autograft is used. Since the All-inside technique uses the tibial and femoral socket instead of the tunnel, it is necessary to reduce the length of the graft. Therefore, one hamstring tendon alone is enough. Various clinical studies have shown that the use of a semitendinosus tendon in the All-inside method could provide similar stability to the knee compared to the standard method (7, 6). On the other hand, harvest of semitendinosus tendon only will be associated with less harvest site morbidity (8).

One of the most special features of the All-inside method is the use of Dual Suspensory Fixation of graft on the femur and tibia. With this method, the pressure applied to the graft is divided between the two sides of the femur and tibia, and therefore the possibility of graft failure is potentially reduced (9). One of the concerns regarding the use of the Adjustable Loop Device is that the Adjustable Loop Device may stretch more than the Fixed Loop Device as obtained by biomechanical studies, but this possibility has not been proven in clinical studies (10, 11).
Despite the progress made in the last two decades, ACL injury is still considered as one of the most debilitating orthopedic injuries and has many physical and psychological effects for athletes, including a long period of absence from sports fields, not returning to sports peak period, and occurrence of premature osteoarthritis. Therefore, the aim of this study was to investigate the outcome of the anterior cruciate ligament reconstruction surgery of the knee using the All-inside method.

Materials and Methods

In this study, patients who visited the orthopedic clinic of Firouzgar Hospital in Tehran, Iran from October 1, 2016 to the end of September 2019 with ACL tears were evaluated according to the study criteria and were included in the study if they were eligible. Out of a total of 124 patients referred in the mentioned time period, 74 patients were excluded from the study, including patients who did not come for follow-up sessions (12 cases), patients with knee Multi Ligament injury (8 cases), patients with meniscus repair (12 cases), patients with anterolateral ligament reconstruction (23 cases), patients with a history of knee surgery (5 cases), and revision patients (4 cases) were excluded from the study. The remaining 50 patients were treated with the All-inside method and were included in this study.

Procedure

After placing the patient in the supine position, a lateral post was used and a high thigh tourniquet was applied. Anteromedial and anterolateral portals were installed.
Semitendinous tendon was harvested and made into Quadrople soft-tissue tendon graft by adjustable suspensory device as described by P.E.Jones and D.J. Schuett,. The mean diameter of the graft was 8.5 ± 0.5 mm. The average length of the graft was 7.1 ± 0.5 mm.

After finding bony anatomic landmarks at native ACL footprint, the femoral socket was created by a conventional reamer through inside-out drilling between the center of the native PL and AM bundles. The tibial socket was also created by a Flipcutter and inside-out drilling approach while the Tibial Aiming Device was placed in the native ACL foot print. Generally, the depth of the femoral and tibial tunnels was 25±0.5 mm, depending on the final length of the graft.

The diameter of the socket was determined according to the diameter of the graft. The graft was pulled into the femoral socket through the anteromedial portal by the Adjustable loop device, and then the Adjustable loop device was passed through the tibial socket and the graft was placed inside the tibial socket. Afterward, cortical suspensory fixation of the graft was performed in 15-20 degrees of knee flexion, while the posterior drawer force was applied to the proximal tibia and the cushion pad under the distal femur to move the femur anteriorly. Finally, Hemovac drain was inserted and the wound was closed.

Post-surgery protocols

Deep vein thrombosis prophylaxis was administered by a subcutaneous dose of Clexane (40 mg/day) for the first two weeks after surgery and oral aspirin (80 mg/day) for the next 2 weeks. After the operation, a knee brace was used for all patients. A standard ACL rehabilitation program was used for all patients, which included immediate full knee extension. The day after the surgery partial weight bearing was started and progress to FWB after one months. Isometric and Q- setting exercise was started the day after operation. Knee flexion reached 90 degrees during 2 weeks, and 120 degrees after 1 month. The knee brace and crutches were maintained for 4 weeks. After that, the patients started walking with the help of a cane on the opposite side, and eventually started walking without a cane.

All surgical complications were entered in the patients' medical records. Lachman test was employed to evaluate knee integrity before and after surgery at last follow up (13). The Pivot Shift test was used to evaluate pre- and post-operative knee stability, and KT-1000 was applied to quantify knee instability (Anterior translation of tibia relative to femur) compared to the healthy knee.

pre and post operative subjective outcome evaluation scales included Tegner Lysholm Knee Score (14) and International Knee Documentation Committee (IKDC) was assessed.

Statistical analysis

SPSS software version 16.0 was used for statistical calculations. Descriptive information was presented as mean ± standard deviation or number (percentage). Shapiro-Wilk test was used to evaluate the normality of the data. Paired t-test or its non-parametric equivalent (Wilcoxon signed-rank test) was employed to compare the mean before and after the operation. Independent T-test or its non-parametric equivalent (Mann-Whitney U test) was applied to compare the mean between two independent groups. Qualitative data were evaluated by Chi-squared test. Pearson's or Spearman's correlation test was used to evaluate possible correlations between variables. Kruskal-Wallis test was employed to analyze ordinal variables. P value less than 0.05 was considered statistically significant.

Ethical declarations

The information of all patients was kept confidential. The study was performed in accordance with the declaration of Helsinki and ethics research committees of the Iran University of Medical Sciences are considered. The study was approved by the Research Council of the Faculty of Medicine, Iran University of Medical Sciences.

Results

The study population consisted of 43 men (86%) and 7 women (14%) with an average age of 28.9 ± 9.6 years. In this study, the result of ACL reconstruction surgery using the All-inside method was

evaluated in 50 patients 12 months after the surgery. Before surgery, Lachman test showed grade 2 in 11 patients (22%) and grade 3 in 39 patients (78%). After surgery, the Lachman test was normal in 30 patients (60%), followed by grade 1 (18 patients, 36%), and grade 2 (2 patients, 4%). The difference of the pre-and post-surgery in Lachman test was found to be statistically significant (P<0.001), (Figure 1)

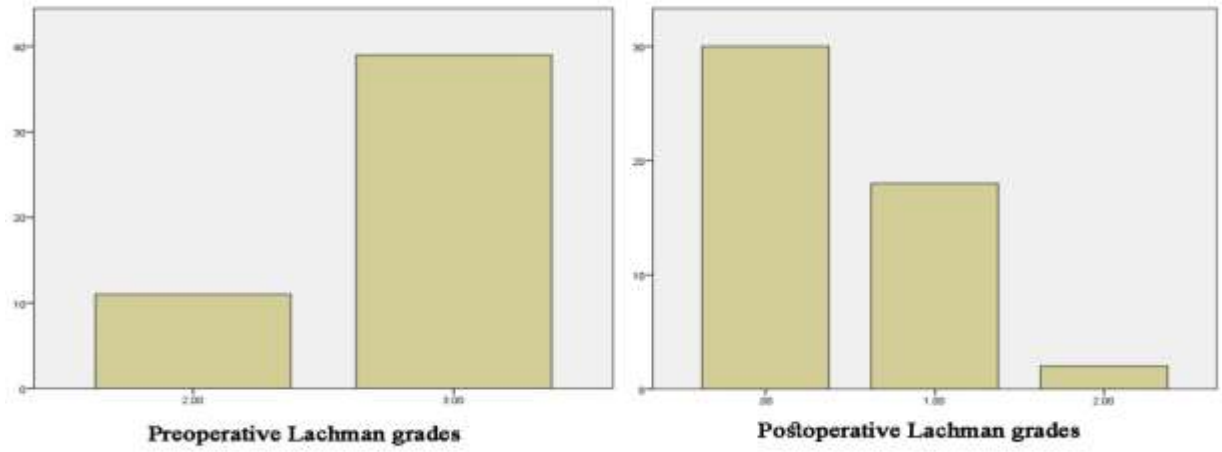

Figure 1: Comparison of Lachman grade of patients before and after treatment with the All-inside method

Before operation, Pivot shift test was determined as +2 in 44 patients (88%), and +3 (6 patients, 12%). Postoperatively, Pivot shift test was found negative in 48 patients (96%), followed by 1+ (2 patients, 4%). This difference was also found to be statistically significant (P<0.001).
The average KT-1000 was 1.4±1.1 mm in the injured knee and 0.3±0.46 mm in the healthy knee. Based on this, a statistically significant difference of 1.1±1 mm was observed between KT-1000 of two knees (P<0.001) (Figure 2).

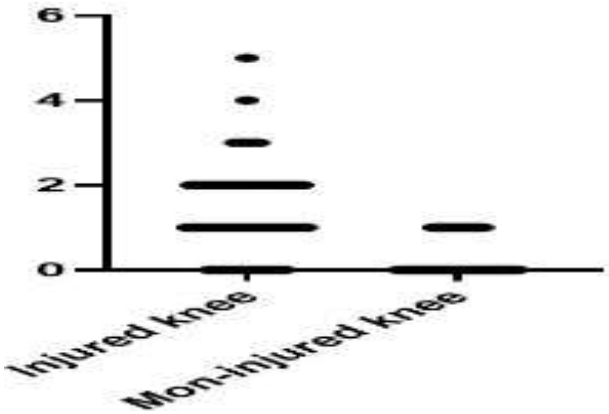

Figure 2: Comparison of the distribution of KT-1000 between the injured knee and the healthy knee 12 months after the All-inside ACL reconstruction surgery.

The average score of IKDC in patients who did physiotherapy was found to be 99±2.4, while it was 96.2±6.4 in patients without physiotherapy. This difference was not found to be statistically significant (P=0.224). The average score of IKDC was 97.3 ± 5.2 in men and 88.3 ± 11.9 in women. This difference was observed to be statistically significant (P=0.004). In addition, a statistically significant correlation was seen between IKDC scores and the number of physiotherapy sessions of patients (r=0.504, P<0.001). No statistically significant correlation was found between the IKDC score of the patients and the clinical characteristics of the patients (Figure 3).

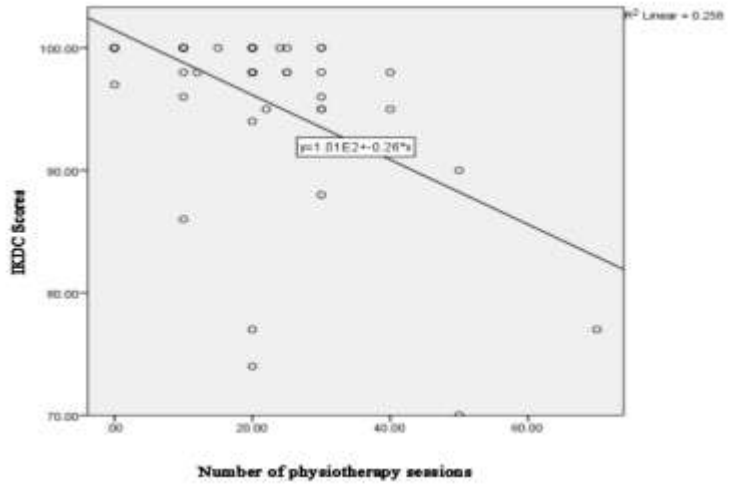

Figure 3: Significant correlation of IKDC score with the number of physiotherapy sessions of patients

According to the Tegner & Lysholm Scale, knee function was excellent in 44 patients (88%), followed by good (3 patients, 6%), and fair (3 patients, 6%). There were no cases of poor performance following ACL reconstruction surgery using the All-inside method.

Complication

No cases of cortical disruption, button failure, or graft failure were observed in this study. A case of superficial infection occurred in one of the patients one month after surgery, which was resolved with local treatment and oral antibiotic therapy. No cases of deep infection or venous thromboembolism were recorded. One year after surgery, 4 patients had mild pain during heavy daily activities. One patient had mild to moderate pain during heavy daily activities. 2 cases of less than 10° limitation full flexion and no other complications were recorded in the patients of this study.

Discussion

Recently, knee trauma has increased due to various reasons, including the expansion of professional sports activities, which leads to limitations and instability in a person's movement, as well as disability. The rehabilitation of injured people has always been the focus of experts (7). The study examines the results of knee anterior cruciate ligament reconstruction surgery using the All Inside method.

In this regard, various studies have been done. In Blackman and Stuart's study, Lachman test and Pivot shift were evaluated six months after anterior cruciate ligament reconstruction in 82 patients. According to the results of this study, the result of Lachman test was grade 0 in 71 patients, followed by grade 1 (11 patients). Pivot shift test was negative in all patients. In the present study, Lachman test was found to be grade 0 in 30 patients, followed by grade 1 in 18 patients, and grade 2 in 2 patients (16).

Pivot shift test was also found to be negative in 48 patients and 1+ in 2 patients. Although the results of the Lachman test in Blackman and Stuart's study were better than the present study, it should be kept in mind that the results of the Lachman and Pivot shift tests largely depend on the preoperative status of these tests. However, Lachman and pivot shift were not reported before the operation of the patients in the Blackman and Stuart study.

Schurz et al (2016) evaluated clinical and functional outcome of all-inside anterior cruciate ligament reconstruction, where the mean side-to-side kt-2000 difference was found to be 1.7 mm, ranging from 0 to 6 mm. using the all-inside method in 79 patients was reported to be 1.7 mm on average (17).

The study of Yasen et al. (2017) showed a significant decrease in the average side-to-side KT-1000 difference after ACL reconstruction surgery to no more than 2.4mm at all postoperative time points.

Lubowitz et al.'s study reported that the side-to-side KT-1000 difference after All-inside ACL reconstruction surgery was between 1.1 and 1.3 mm (9). In the present study, the side-to-side difference of KT-1000 after ACL reconstruction surgery by All-inside method was determined to be 1.1 on average, which was consistent with the results of previous studies.

In the study of Benea et al., the average knee range of motion improved from 131.4 degrees to 133.6 degrees after ACL reconstruction surgery using the All-inside method (19). In Yasen et al.'s study, knee range of motion 2 years after All-inside ACL reconstruction surgery was almost similar to healthy knee (139 vs. 141.6 degrees) (18).

According to Volpi et al.'s study, Lysholm scale after all-inside ACL reconstruction was excellent in 65% of patients, followed by good results (35%). The IKDC score of patients was reported as normal (55% of patients), close to normal (40%), and abnormal (5%), (6).

Based on the findings presented by Benea etal. (2014), the IKDC score of patients 6 months after ACL reconstruction using the All-inside method was reported to be 81.3 on average. Accordingly, the IKDC determined 54.5% of patients as normal, 36.4% as near normal, and 9.1% as abnormal patients (19).

In a systematic review conducted by Connaughton et al., the average IKDC score after all-inside ACL reconstruction was between 83.8 and 89.7. Based on this, study evaluated 55 to 100% of patients as normal group, 0 to 50% as near-normal group, and 0 to 5% of patients as abnormal group (5). The IKDC score of patients 12 and 6 months after ACL reconstruction using the All-inside method was 96.1 on average. This result was significantly better than the IKDC score reported in most of the past studies.

In another systematic review conducted by Connaughton et al., the Lysholm scale after all-inside ACL reconstruction averaged between 90.9 and 93.1 (5). In the present study, 88% of patients scored between 95-100 after ACL reconstruction using the All-inside method, which was comparable to the results of previous studies.

Lubowitz et al. (2013) investigated the postoperative complications of ACL reconstruction using the All-inside method in 60 patients after 2 years, where no complications were observed after ACL reconstruction in the patients of this study (9). The study conducted by Schurz et al., showed that 10 patients out of 79 patients (12.7%) experienced graft rerupture 17.6 months after ACL reconstruction using the All-inside method (17). In the study of Yasen and his colleagues, graft re-rupture occurred in 6.5% of patients after ACL reconstruction using the All-inside method due to post-surgical trauma (18). In the study of Chandratreya et al., (20), 16 patients out of 138 patients presented complications including arthrofibrosis (n=4), infection (n=2), haemarthrosis (n=1) and metalwork failure (n=1). Graft re-rupture occurred in 8 (5.7%) patients.

In a systematic review conducted by de Sa D etal. (21), a total of 31 complications (5.89%) in patients who underwent ACL using the All-inside, was reported, which included graft rerupture (2.47%), loss of extension of 1° to 10° (1.14%), and cartilage or meniscus injuries on the operated knee (0.760%). However, no case of graft rerupture was observed in the present study. This could be due to the precision used in the surgical technique of this study. In order to reduce the possibility of graft failure, we avoided entrapment of the button in the soft tissue and tried to place it exactly in the vicinity of the cortex in order to minimize the possibility of graft loosening. In addition, we tried to maintain the thickness of the cortex as much as possible and to not damage the remnant of ACL on Tibia during the process of creating the socket.

Conclusion

All-inside ACL reconstruction surgery can be considered as a safe and effective method in patients with ACL rupture. In addition to the fact that this method creates a good functional result for the patients and brings the stability of the knee to an acceptable level (because in this method graft size is more than other methods (8-9 mm) that are used hamstring Tendons), it is also associated with few complications.

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