

## A Comparative Study of Reconstruction Surgery and Physiotherapy in Anterior Cruciate Ligament Tears

### Abstract

**Introduction:** The anterior cruciate ligament (ACL) is one of the crucial ligaments in the knee that often gets injured during intense activities. This injury, sometimes resulting in a tear, is more common among professional athletes. The aim of this study is to compare reconstruction surgery and physiotherapy treatments in an educational hospital.

**Materials and Methods:** In a cross-sectional study, 63 individuals aged between 19 and 38 with ACL injuries, categorized into four occupational groups (soldiers, military personnel, athletes, and freelancers), were examined. Thirty-two individuals underwent reconstruction surgery, while 31 underwent physiotherapy. Patients were followed up for one to six months. The International Knee Documentation Committee (IKDC) questionnaire was completed for them, and the collected data were entered into SPSS for analysis using two-way ANOVA and Bonferroni post hoc test.

**Results:** The results showed that both the type of treatment and occupation had an impact. Surgical reconstruction scored significantly higher than physiotherapy (surgery group:  $69.7 \pm 0.7$ , physiotherapy group:  $66.3 \pm 1.0$ ). Among occupations, soldiers scored significantly lower than the other groups, with no significant difference observed among freelancers, military personnel, and athletes.

**Conclusion:** The findings indicate that both the chosen treatment method and the patient's occupation are effective in follow-up. Excluding pain criteria, surgical reconstruction was markedly superior to physiotherapy, as patients exhibited higher sports and functional performance despite experiencing more pain, resulting in higher scores.

**Keywords:** Anterior cruciate ligament, Anterior Cruciate Ligament Reconstruction, Physical Therapy, Outcome Assessment

*Accepted: 15 days before printing*

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### Introduction

The knee joint, besides performing flexion and extension, also carries out rotational movements. Unlike the hip joint, the knee joint is shallow and relies on the surrounding soft tissue for stability. The stability of any joint depends on the integrity of its ligamentous structures. If a joint naturally has a high degree of mobility, the role of ligaments becomes even more crucial. However, due to the significant stress exerted during walking, running, and jumping, the knee joint is more susceptible to injury compared to other joints<sup>(1-4)</sup>.

The anterior cruciate ligament (ACL) is one of the key ligaments in the knee, possessing strength comparable to the medial collateral ligament and half the strength of the posterior cruciate ligament. This ligament is prone to injury during intense physical activities, with tears commonly occurring among professional athletes. If the force applied is substantial, there is also a possibility of injury to the medial collateral ligament and the medial meniscus<sup>(5-6)</sup>.

The mechanism of ACL injury typically involves external rotation of the knee combined with valgus force (the most common scenario) or trauma causing the proximal end of the tibia to be driven forward relative to the femur, or severe hyperextension due to trauma. The causes of ACL injury include environmental factors such as sports and trauma, as well as anatomical factors, with the mid-portion of the ligament being most susceptible to injury<sup>(7-9)</sup>.

**Table 1: Total Score from the International Knee Documentation Committee (IKDC) Questionnaire**

Group	Soldier	Self-Employed	Overall	Treatment	Treatment	Treatment
Surgery	67.0 ± 1.0	70.0 ± 1.0	73.0 ± 1.1	74.0 ± 0.9	69.7 ± 0.7	F=9.001
Physiotherapy	62.0 ± 1.2	68.0 ± 1.4	70.0 ± 1.3	72.0 ± 0.9	66.3 ± 1.0	p=0.004
Overall	64.7 ± 0.9	68.9 ± 0.9	71.6 ± 0.9	73.0 ± 0.7		
Occupation	p=0.000		F=18.187			

Treatment for ACL tears can be either surgical or non-surgical, with the choice of treatment depending on the type of injury, associated injuries, the patient's age, and their activities, such as occupation and lifestyle<sup>(10-11)</sup>. The exact incidence of ACL injuries is not known, but it is estimated that approximately 200,000 ACL tears occur annually in the United States, with about 100,000 undergoing reconstruction each year<sup>(12-13)</sup>. There is ongoing debate about whether graft reconstruction is the best option or if surgery is necessary at all. Over the past two decades, more than 2,000 scientific articles and several textbooks have been published on the ACL<sup>(14-16)</sup>. Additionally, national health organizations like MOON and MARS have brought together various orthopedic surgeons to identify predictors of poor outcomes in ACL reconstruction surgeries. These groups have conducted large-scale studies over different follow-up periods to investigate this issue<sup>(17-18)</sup>.

## Materials and Methods

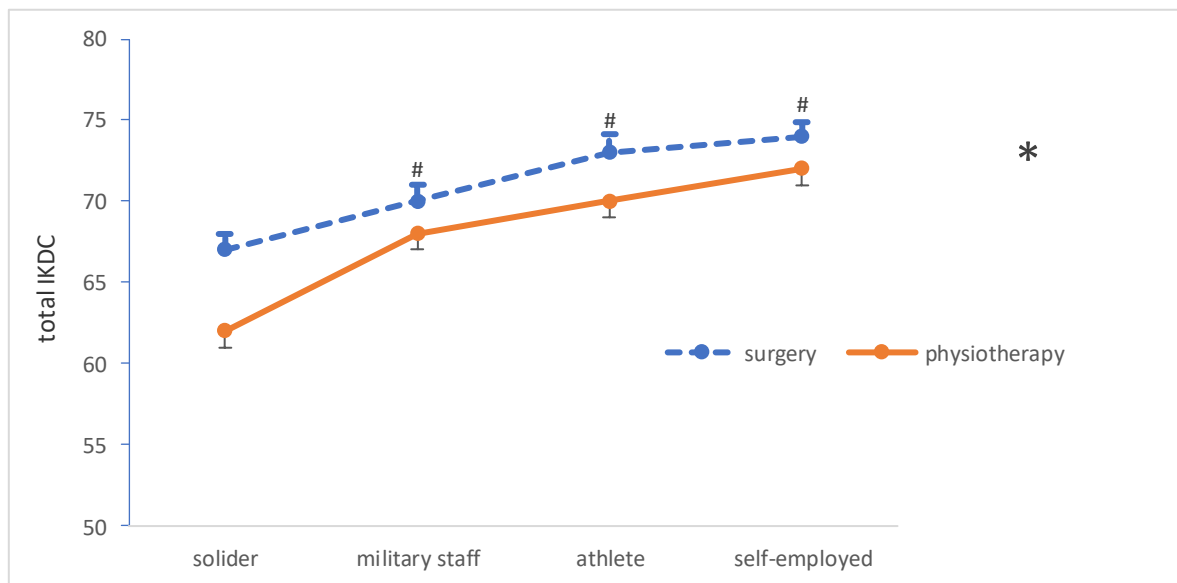
This study, after obtaining ethical approval from the Ethics Committee of the AJA University of Medical Sciences (Ethics ID: IR.AJAUMS.REC.1398.069), was conducted from 2012 to 2019 on patients with ACL injuries who visited the orthopedic surgery clinic at Imam Reza Hospital in Tehran.

Data collection was conducted based on census sampling through questionnaires filled out by patients and available records from 2012 to 2019. The questionnaire included demographic and personal information variables such as age, gender (male and female), occupation (soldier, military staff, athlete, and self-employed), and history of underlying diseases (diabetes and rheumatological diseases). The validity and reliability of the

questionnaire were assessed by experts before use. The International Knee Documentation Committee (IKDC) questionnaire, translated into Persian by the Akhtar Orthopedic Research Center, was used. This Persian version of the IKDC questionnaire, specific to knee patients, is a reliable and repeatable tool for assessing and designing rehabilitation programs for Iranian patients after ACL and meniscus surgeries. The IKDC questionnaire includes 3 subscales and 18 items, assessing clinical symptoms (items 1-7), sports activity performance (items 8-17), and overall function (item 18). It measures clinical symptoms by evaluating pain, stiffness, swelling, locking, and joint instability, functional ability by assessing the ability to perform daily activities, and activity level by evaluating the ability to run, jump, land, stop and start suddenly, climb stairs, stand, kneel, sit on a bent knee, and rise from a chair. Various scoring methods exist for this questionnaire, but summing the scores of each item has been shown to be the best method, with higher total scores indicating higher levels of function and milder clinical symptoms<sup>(19)</sup>.

All patients in the study underwent surgery by two orthopedic surgeons, both using the hamstring graft method. Other patients underwent physiotherapy. The physiotherapy in the non-surgical treatment group involved routine knee exercises aimed at strengthening the muscles around the knee and improving the range of motion. Follow-up duration varied between patients from one to six months post-injury.

After data collection and extraction, all information was entered into SPSS software version 21. Descriptive statistics using frequency tables and means were used to describe the research data. For statistical analysis and comparison of IKDC questionnaire scores, which included pain and



**Figure 1: Total score from the International Knee Documentation Committee (IKDC) questionnaire. Data are expressed as mean ± SEM and were analyzed using two-way ANOVA and Bonferroni post-hoc tests. \* indicates a significant difference with the surgery group, and # indicates a significant difference with the soldier group.**

sports activity after treatment, two-way ANOVA and Bonferroni post hoc test were used, with a significance level of  $P < 0.05$ .

## Results

This retrospective study included 81 patients, with 18 excluded due to exit criteria or complications following surgical or non-surgical treatment. Nine patients from the surgical group and nine from the physiotherapy group were excluded. In the surgical group, one patient was excluded due to postoperative infection, two due to surgical technique issues, three due to re-rupture, and three due to missing data. In the physiotherapy group, two patients were excluded due to a change in treatment approach from physiotherapy to surgery, five due to missing data during follow-up, and two due to other injuries such as accidents, knee fractures, and rheumatological diseases. Ultimately, 63 patients were studied. of these, 50.8% underwent hamstring graft reconstruction surgery, and 49.2% received physiotherapy. The mean age in the surgical group was 27.78 years, ranging from 19 to 39 years. In the physiotherapy group, the mean age was 28.40 years, ranging from 18 to 39 years. Among the 63 participants, 32 underwent reconstruction surgery, with 8 also having medial

meniscus injuries and 4 having lateral meniscus injuries. of the 31 patients treated with physiotherapy, 10 had medial meniscus injuries and 3 had lateral meniscus injuries. In the IKDC questionnaire total score, which includes 18 items, the surgical group scored  $69.7 \pm 0.7$ , while the physiotherapy group scored  $66.3 \pm 1.0$ . The type of treatment ( $F=9.001$ ;  $P=0.004$ ) and occupation ( $F=18.187$ ;  $P=0.000$ ) had significant impacts (Table 1).

However, when we excluded the pain criterion from the metrics in this study, the type of treatment became significant with  $F=90.400$ ;  $P=0.000$ . When we used only the pain criterion for evaluation, the International Knee Documentation Committee (IKDC) score for the physiotherapy group was higher than for the group that underwent reconstructive surgery. Examining the pain scores from the IKDC questionnaire, which includes 24 points, the physiotherapy group scored an average of 19.4, compared to 14.6 for the surgery group. This means that the physiotherapy group experienced less pain, whereas the surgery group reported more pain and dissatisfaction. Based on occupation, only the group with freelance jobs showed a significant difference in pain compared to the soldiers. Both the type of treatment and the type of occupation had an impact ( $F=9.001$ ;  $p=0.004$  and  $F=18.187$ ;  $p=0.000$ , respectively).

Furthermore, when we evaluated the criteria for physical activity in this study, the reconstructive surgery group scored better with an average of 29.2 compared to 22.9 for the physiotherapy group. This indicates that the reconstructive surgery group engaged in higher levels of physical activity post-treatment. Regarding occupation, the military personnel, athletes, and freelancers demonstrated significant difference in physical activity levels compared to soldiers, with higher activity levels post-treatment.

In reporting the IKDC total score, excluding the three pain items (questions 1, 2, and 3), the type of treatment ( $F=90.400$ ;  $P=0.000$ ) and occupation ( $F=13.426$ ;  $P=0.000$ ) had significant effects. In reporting the IKDC score for sports activities, covering items 8 to 17 and including 36 points, both treatment type ( $F=74.527$ ;  $P=0.000$ ) and occupation ( $F=42.27$ ;  $P=0.001$ ) had significant effects. Bonferroni post-hoc tests showed that the surgery group scored significantly higher than the physiotherapy group. Among occupations, soldiers scored significantly lower than others, with no significant difference observed among freelancers, military staff, and athletes.

In reporting the IKDC pain score, which covers items 1, 2, and 3 and totals 24 points, both treatment type ( $F=52.119$ ;  $P=0.000$ ) and occupation ( $F=4.132$ ;  $P=0.010$ ) had significant effects. Bonferroni post-hoc tests showed that the pain score for the surgery group was significantly lower than that for the physiotherapy group. Among occupations, only freelancers showed a significant difference in pain score compared to soldiers.

## Discussion

In this study, based on occupation, although soldiers who underwent reconstructive surgery had higher total scores than those who received physiotherapy, soldiers in both treatment groups scored lower than other occupations. The findings from this study, based on IKDC scores and statistical analysis, showed that both treatment type and occupation had significant effects ( $F=9.001$ ;  $P=0.004$  and  $F=18.187$ ;  $P=0.000$ , respectively). Specifically, surgical treatment scored higher than physiotherapy, and soldiers scored lower than the other three occupations. No significant difference were observed among freelancers, military staff, and athletes.

A study conducted between 2002 and 2007 at Shariati Hospital evaluated the short-term outcomes of ACL reconstruction in patients using the IKDC questionnaire to compare pre- and post-operative conditions. The study concluded that arthroscopic ACL reconstruction was a suitable and safe method<sup>(20)</sup>.

A 2008 study in Germany compared ACL reconstruction and conservative treatment over an 11-year follow-up period. This study evaluated clinical, radiologic, and IKDC scores, showing that knee stability and osteoarthritis were higher post-reconstruction, but physical activity levels were similar in both groups. However, our study found higher post-treatment activity levels in the surgery group, although they had higher pain scores. Osteoarthritis was not assessed due to the limited follow-up time<sup>(21)</sup>.

A meta-analysis published in October 2013 in Norway aimed to determine the most optimal and cost-effective ACL tear treatment strategy. This meta-analysis found limited evidence showing superiority between surgical and non-surgical methods in functional outcomes. It recommended non-surgical interventions before surgery, contrasting with our findings where surgical reconstruction was preferable, especially when the pain criterion was excluded<sup>(22)</sup>.

**Limitations:** This study used questionnaires for data collection, which may result in some participants providing inaccurate responses. Additionally, the cross-sectional nature of the study makes it difficult to establish causality. The lengthy questionnaire may have affected the accuracy of responses, but the high number of questions also allowed for more precise conclusions.

## Conclusion

This study compared reconstructive surgery and physiotherapy, finding that surgical treatment had significantly higher scores. Occupation also significantly affected scores. Overall, the surgery group had fewer clinical symptoms and better functional performance. Excluding the pain criterion, reconstructive surgery was even more favorable. Despite experiencing more pain, those who underwent surgery demonstrated higher sports and functional activity levels compared to the physiotherapy group.

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