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Original Research Article **Orthopaedic Surgery**

Preoperative vs. Postoperative Functional and Pain Status in Arthroscopic ACL Reconstruction Using Quadriceps Tendon

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Abstract

Introduction: Anterior cruciate ligament (ACL) injuries significantly impact mobility and overall quality of life, necessitating prompt and effective intervention. The purpose of this study was to assess preoperative versus postoperative functional and pain status in arthroscopic ACL reconstruction using the quadriceps tendon. ***Aim of the study:*** The aim of the study was to evaluate preoperative versus postoperative functional and pain status in arthroscopic ACL reconstruction using the quadriceps tendon. ***Methods:*** This prospective interventional study was conducted in the Department of Orthopaedic Surgery at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from March 2020 to August 2022, enrolling 30 patients with isolated anterior cruciate ligament (ACL) injuries. Informed consent was obtained, and diagnoses were established through X-rays and MRI. Outcome measures were evaluated using the Lysholm score, Tegner score, and Visual Analogue Scale (VAS) at follow-up intervals, with statistical analysis conducted using SPSS version 26.0. ***Result:*** The study of 30 patients (mean age 29.73 ± 7.00 years, 90% male) found significant improvements post-surgery: Lysholm scores rose from 48.57 to 89.63, Tegner scores from 3.03 to 7.10, and VAS pain scores dropped from 0.90 to 0.20 (all $p < 0.001$). ***Conclusion:*** Arthroscopic ACL reconstruction using the quadriceps tendon led to significant improvements in knee function, enhanced activity levels, and reduced pain, demonstrating its effectiveness in restoring pre-injury status.

Keywords: ACL Reconstruction, Quadriceps Tendon, Functional Status, Pain Assessment, Arthroscopic Surgery.

INTRODUCTION

Anterior cruciate ligament (ACL) injuries rank among the most prevalent ligament injuries in the knee, with annual incidence rates of 68.6 per 100,000 person-years and approximately 80 occurrences per 100,000 individuals each year [1,2]. These injuries can lead to serious complications, including knee instability, motor control deficits, and disrupted arthrokinematics [3]. Consequently, ACL ruptures significantly affect mobility and overall quality of life, highlighting the necessity for prompt and effective intervention.

Surgical reconstruction is the primary treatment for ACL injuries, aimed at restoring normal knee biomechanics, reducing instability, and facilitating a return to preinjury activity levels [4]. The objectives of ACL reconstruction encompass enhancing daily functional capacity and addressing the psychological aspects related to the injury [5,6]. Various graft options are utilized, with the bone-patellar tendon-bone (BPTB) autograft being the standard choice due to its mechanical strength, reliable fixation, and fast healing period [7,8]. Appropriate surgical intervention is essential, particularly for acute grade 3 or 4 injuries, as well as in

cases involving multiple ligament injuries or meniscal damage.

The quadriceps tendon (QT) is increasingly recognized as a viable option for ACL reconstruction. Discussed as a graft choice since the 1970s, initially by MacIntosh and later by Marshall, the QT underscores its historical relevance in surgical practice [9,10]. It exhibits adequate biomechanical and morphological properties, [11] with outcomes comparable to traditional grafts like hamstring tendon (HT) and patellar tendon (PT), emphasizing its effectiveness [12,13] Additionally, the QT presents advantages, such as a lower risk of donor site morbidity compared to other graft types, making it a reliable choice for primary ACL reconstruction across all patient demographics [14,15] Ultimately, the quadriceps tendon demonstrates sufficient strength and functional outcomes, positively impacting the rehabilitation process and overall patient recovery [16-18].

Current literature highlights that return to sports participation after ACL reconstruction (ACLR) is often inadequate, even when patients achieve successful functional outcomes [19] For instance, a recent cohort study revealed that at one year post-surgery, only 24% of individuals had returned to their pre-injury level of sport, despite 91% expecting to do so preoperatively [20]. Furthermore, recent studies suggest that preoperative quadriceps strength is associated with improved postoperative strength and knee function [21]. However, while fundamental data indicate that force-generating capacity prior to immobilization predicts post-interventional torque, this interrelation has yet to be clinically established in orthopedic patients suffering from ACL rupture [22]. These gaps in the literature underscore the need for further research to explore the role of quadriceps tendon use in improving postoperative outcomes, particularly in the context of strength and functional recovery. The purpose of this study was to assess preoperative versus postoperative functional and pain status in arthroscopic ACL reconstruction using the quadriceps tendon.

Objectives

- The aim of the study was to evaluate preoperative versus postoperative functional and pain status in arthroscopic ACL reconstruction using the quadriceps tendon.

METHODOLOGY & MATERIALS

This prospective interventional study was conducted at the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from March 2020 to August 2022, involving 30 patients diagnosed with isolated anterior cruciate ligament (ACL) injuries.

Inclusion Criteria:

- Isolated ACL injuries without concomitant ligament injuries.
- Unilateral ACL injuries.
- Age between 18 and 45 years.
- Both genders.
- Willingness to undergo follow-up evaluations.

Exclusion Criteria:

- History of previous surgery on the affected knee.
- Fractures around the knee (femoral condyle, tibial plateau, patella).
- Meniscal injuries.
- Osteoarthritis in the knee.

Informed consent was obtained to ensure confidentiality and voluntary participation. A thorough history and physical examination were conducted for each patient using a structured case record form, with clinical and radiological diagnoses established through X-rays and MRI of the injured knee. Symptoms, including knee injury history, pain, swelling, and instability, were assessed alongside objective signs such as gait, alignment, and range of motion. Subsequently, arthroscopic isolated ACL reconstruction was performed using the quadriceps tendon. Outcome measures were evaluated using the Lysholm score, Tegner score, and Visual Analogue Scale (VAS) at follow-up intervals of 2 weeks, 6 weeks, 3 months, 6 months, and 9 months post-surgery. Statistical analysis was conducted using SPSS version 26.0, presenting quantitative data as mean and standard deviation (±SD) and qualitative data as frequency and percentage. Comparisons between preoperative and postoperative outcomes were made using paired Student's t-test for quantitative data and Wilcoxon Rank Sum test for qualitative data, with a significance level set at $p < 0.05$. The study received ethical clearance from the Institutional Review Board (IRB) of BSMMU, ensuring patient confidentiality and focusing on improvements in functional scores and pain levels following ACL reconstruction.

RESULT

Table 1: Demographic Characteristics of the Study Population (n = 30)

Variable		Frequency (n)	Percentage (%)
Age (in years)	18-25	10	33.30%
	26-35	15	50.00%
	36-45	5	16.70%
	Mean±SD	29.73 ± 7.00	

Variable		Frequency (n)	Percentage (%)
Gender	Male	27	90.00%
	Female	3	10.00%
Occupation	Service holder	12	40.00%
	Businessmen	8	26.70%
	Housewife	3	10.00%
	Others	7	23.30%
Site of involveme	Right anterior cruciate ligament injury	21	70.00%
	Left anterior cruciate ligament injury	9	30.00%

The study involved 30 patients. Among them, 10 (33.3%) were aged 18-25 years, 15 (50%) were 26-35 years, and 5 (16.7%) were 36-45 years, with the youngest and oldest participants being 18 and 45 years, respectively. The mean ± SD age was 29.73 ± 7.00 years, with the majority (50%) in the 26-35 age group. In terms of gender distribution, 27 (90%) were male and 3 (10%) were female, with a male-to-female ratio of 9:1. Regarding occupation, 12 (40%) participants were service holders, followed by 8 (26.7%) businessmen, 3 (10%) housewives, and 7 (23.3%) categorized as others. Most patients (70%) had right ACL injuries, while 30% had left ACL injuries.

Table 2: Distribution of study population according to Lysholm score (n=30).

Lysholm Score	Preoperative	Postoperative	p-value
Poor (<65)	30 (100%)	0 (0%)	<0.001s
Fair (65 to 83)	0 (0%)	4 (13.3%)	
Good (84 to 90)	0 (0%)	8 (26.7%)	
Excellent (>90)	0 (0%)	18 (60%)	
Mean ± SD (Range)	48.57 ± 7.41 (40-64)	89.63 ± 4.18 (81-96)	

The Lysholm score, which assesses knee function, was poor in all cases preoperatively. Nine months after isolated arthroscopic ACL reconstruction with a quadriceps tendon graft, the Lysholm score improved to *excellent* in 18 (60%) cases, *good* in 8 (26.7%) cases, and *fair* in 4 (13.3%) cases. The mean ± SD preoperative Lysholm score was 48.57 ± 7.41 (range: 40-64), which increased to 89.63 ± 4.18 (range: 81-96) postoperatively. This improvement was statistically significant ($p < 0.001$).

Table 3: Comparison of preoperative and postoperative Tegner activity level score (n=30).

Tegner Activity Score	Preoperative	Postoperative	p-value
0	0 (0%)	0 (0%)	
1	0 (0%)	0 (0%)	
2	12 (40%)	0 (0%)	
3	8 (26.7%)	0 (0%)	
4	7 (23.3%)	1 (3.3%)	
5	3 (10%)	1 (3.3%)	
6	0 (0%)	5 (16.7%)	
7	0 (0%)	14 (46.7%)	
8	0 (0%)	6 (20%)	
9	0 (0%)	3 (10%)	
10	0 (0%)	0 (0%)	
Mean ± SD	3.03 ± 1.03	7.10 ± 1.12	<0.001

The Tegner activity level score, used to assess activity levels, showed a significant increase following surgery. The mean preoperative score was 3.03 ± 1.03 (range: 2-5), which improved to 7.10 ± 1.12 (range: 4-9) at the final follow-up, nine months postoperatively. This improvement from preoperative to postoperative status was statistically significant ($p < 0.001$).

Table 4: Distribution of study population according to VAS scale (n=30).

VAS Score	Preoperative	Postoperative	p-value
No pain	23 (76.7%)	25 (83.3%)	
Mild pain	2 (6.7%)	5 (16.7%)	
Moderate pain	5 (16.7%)	0 (0%)	
Severe pain	0 (0%)	0 (0%)	
Mean ± SD	0.90 ± 1.77	0.20 ± 0.48	0.001

The Visual Analog Scale (VAS) was used to assess pain levels. Preoperatively, the mean VAS score was 0.90 ± 1.77, with 23 (76.7%) patients reporting no pain, 2 (6.7%) reporting mild pain, and 5 (16.7%) reporting moderate pain. Nine months postoperatively, the mean VAS score decreased to 0.20 ± 0.48. At the final follow-up, 25 (83.3%) patients reported no pain, and 5 (16.7%) experienced mild pain, with no cases of moderate or severe pain. The reduction in pain was statistically significant (p = 0.001).

DISCUSSION

Injury to the anterior cruciate ligament (ACL) commonly occurs during sports, with arthroscopic ACL reconstruction using autografts being the preferred treatment. Our study, utilizing the quadriceps tendon as the graft material, showed promising results consistent with outcomes reported for other graft types. This prospective interventional study evaluated the preoperative and postoperative functional and pain outcomes of isolated arthroscopic ACL reconstruction using the quadriceps tendon. Conducted between March 2020 and August 2022 at the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, the study found significant improvements in knee function, activity levels, and pain status at the nine-month follow-up, demonstrating the graft's effectiveness in enhancing recovery.

In this study, the mean ± SD age of participants was 29.73 ± 7.00 years, with half (50%) of the patients aged 26-35 years. The youngest and oldest patients were 18 and 45 years, respectively, aligning with findings from another study, who reported almost similar mean age of 26.8 years in their study [23]. Males constituted the majority (90%) of the study population, resulting in a 9:1 male-to-female ratio, consistent with another study [24]. In terms of occupation, 40% of the participants were service holders, followed by businessmen (26.7%), housewives (10%), and others (23.3%). Right-sided ACL injuries were more prevalent (70%) compared to left-sided ones, reflecting the tendency for injury patterns to favor the dominant leg.

In this study, the preoperative Lysholm score was poor in all cases. Nine months after arthroscopic isolated ACL reconstruction with the quadriceps tendon, the Lysholm score was excellent in 60% of the patients, good in 26.7%, and fair in 13.3%. These findings align with previous research; for instance, Sofu *et al.*, [23] reported similar results in Turkey. Additionally, Sharma *et al.*, [24] noted that average Lysholm scores improved from a preoperative value of 44.34 to 78.98, 87.86, and 91.58 at three months, six months, and one year, respectively, with statistically significant differences ($p < 0.05$) at all follow-up visits. Cavaignac *et al.*, [25] also found that the functional outcome of arthroscopic isolated ACL reconstruction with quadriceps tendon yielded a Lysholm score of 89.6 ± 6.9, which closely corresponds to the score of 89.63 ± 4.18 observed in this study.

In this study, the mean preoperative Tegner activity score for the 30 participants was 3.03 ± 1.03 (range: 2-5). After nine months of follow-up, the mean Tegner activity level improved to 7.10 ± 1.12 (range: 4-9). This significant improvement from preoperative to postoperative values was statistically significant ($p < 0.001$), aligning with findings from Galan *et al.*, [26].

In this study, the preoperative VAS score in this study was 0.90 ± 1.77, while the postoperative VAS score was 0.20 ± 0.48. This reduction in the VAS score at nine months post-surgery was significant (p = 0.001). Niederer *et al.*, similarly reported a significant decrease in mean pain levels following surgery, with patients expressing high satisfaction with their outcomes [27].

The promising results of this study underscore the effectiveness of arthroscopic ACL reconstruction using the quadriceps tendon in enhancing patients' functional capabilities and alleviating pain. These findings contribute valuable insights into the potential benefits of this surgical technique, emphasizing its role in improving quality of life for individuals with ACL injuries. Future studies may provide further evidence to solidify these outcomes and guide clinical practices.

Limitations of the study

Despite efforts to maintain high standards throughout the study, certain limitations remain:

- The study was conducted at a single hospital, limiting the generalizability of the findings to the broader population.
- A purposive sampling method was used, introducing potential bias that could influence the results.

CONCLUSION

From the results of this study, it can be concluded that arthroscopic ACL reconstruction using the quadriceps tendon led to significant improvements in functional and pain status. Postoperative Lysholm and Tegner scores showed enhanced knee function and activity levels, while VAS scores indicated reduced pain, demonstrating the procedure's effectiveness in restoring knee function compared to preoperative status.

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