Annals of Medicine and Surgery 84 (2022) 104940

Contents lists available at ScienceDirect

Annals of Medicine and Surgery

journal homepage: www.elsevier.com/locate/amsu

Cohort Study

Patellofemoral functional outcome of gracilis sparing compared to gracilis sacrificing ACL reconstruction

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ARTICLE INFO

Keywords:
ACL Rupture
Gracilis sparing and sacrificing
Hamstring autograft
Kujala score

ABSTRACT

Introduction: The hamstring is the most popular autograft used for anterior cruciate ligament reconstruction (ACLR). Despite its excellent outcome, donor site morbidity is also irritating. Patellofemoral problems are reported to be one of the side effects after hamstring autograft harvesting, suggested to be due to both gracilis & semitendinosus sacrificing. Some experts propose retaining gracilis to decrease patellofemoral problems. The all-inside technique is an advantageous ACLR technique that can preserve the gracilis muscle while reducing muscle strength loss of affected limbs and the risk of knee joint instability under rotational load. This study aims to compare the patellofemoral functional outcome of both gracilis sparing and sacrificing using a validated Kujala score three months after ACLR.

Methods: There was total of 20 subjects who underwent ACLR between December 2021 and May 2022 and met the inclusion criteria. They were then grouped into gracilis sparing group (n = 10) and gracilis sacrificing group (n = 10). Follow up assessment (Kujala Score) was conducted during phase II of the rehabilitation program. The assessed variables were surgery technique, time of surgery-to-evaluation, and Kujala Score.

Result: There were no significant differences in Kujala Score between gracilis sparing and gracilis sacrificing groups (p = 0.809). There was a strong positive correlation between the time of surgery-to-evaluation and Kujala Score in each group (p = 0.942 and p = 0.910, respectively).

Conclusion: There are no differences in patellofemoral functional outcomes between patients who undergo gracilis sparing and gracilis sacrificing ACLR with good scores of Kujala, which means both gracilis sparing and sacrificing show no harm to the patellofemoral after the ACLR.

1. Introduction

Injury to the Anterior Cruciate Ligament (ACL) is one of the most common knee injuries, resulting in laxity, functional instability, an increased risk of meniscal injury, and degenerative joint disorders [1]. Worldwide, the overall incidence of an ACL tear is 74.6 per 100,000 people [2]. The number of ACL implants utilized in ACL surgery in Indonesia increased by 42% in 2019, 661 more than in 2018. (1575 implants in 2018 vs 2236 in 2019, based on unpublished data from the three main ACL-implant companies in Indonesia) [3]. Some aspects of ACL surgery, including graft selection, placement, fixation, tensioning, and post-operative rehabilitation protocols, are highly controversial. The primary objective of ACL surgery is to stabilize the knee without limiting motion and prevent further damage to an unstable joint. The degenerative arthritis probability, however, will still increase whether reconstruction is undertaken or not. Therefore, many ongoing types of research are conducted to find alternative techniques to enhance short- and long-term results.

ACL reconstruction is currently one of the most common surgical procedures for ACL injury, intending to achieve a more anatomical and less invasive reconstruction method to return patients to their preinjury activity levels [4,5]. With the evolution of arthroscopy equipment, technology, and basic research, arthroscopic ACL reconstruction has become a common treatment because of its positive clinical efficacy. The transportal and All inside techniques are currently the most common procedures used in ACL reconstruction.

All-inside ACL restoration has been shown to cause less discomfort and preserve bone [6]. All-inside ACL repair removed the requirement for a complete transtibial tunnel by using a high anteromedial portal to drill a tibial socket from the inside out, followed by graft fixation with an

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https://doi.org/10.1016/j.amsu.2022.104940
Received 31 August 2022; Received in revised form 24 October 2022; Accepted 12 November 2022
Available online 1 December 2022

interference screw through the same portal. Due to their technical difficulties, these strategies never acquired widespread acceptance [7]. In modern clinical practice, the transportal (TP) and all-inside methods (AIT) are the most often employed reconstruction techniques. However, with many options in the technique, graft sources, and the devices used, many complications may occur in any options, including quadriceps weakness, hamstring weakness, range of motion (ROM) deficits, and patellofemoral problems.

Patellofemoral pain, one of the patellofemoral problems, has been reported in post-ACL reconstruction patients [8,9]. Bone-patellar tendon-bone (BPTP) autograft, the usual graft source for ACL restoration, has the highest prevalence of patellofemoral discomfort compared to alternative techniques. Hence, Hamstring tendon autograft is popular as the alternative to the BPTP. The advantages of the Hamstring tendon are that the graft harvest only needs a small incision, decreased perioperative pain, less anterior knee pain, and high load to failure [10]. In addition, more patients who received ACLR with BPTB grafts as opposed to hamstring autografts experienced residual knee pain after the procedure [4]. However, other studies also state that connected to hamstring autograft harvesting is the suspected cause of Patellofemoral pain following ACL reconstruction of the hamstring tendon in 30% of patients and 8.5% in different studies [9,11]. The precise mechanism is still unknown, but some studies suspect that lateral shift of the patella due to lack of internal rotation force of tibiofemoral in decreased hamstring strength causes the patellofemoral pain [12]. This study aims to compare the patellofemoral functional outcome of both gracilis sparing and sacrificing using a validated Kujala score three months after ACLR.

2. Methods

2.1. Study design and subject selection

This study is a retrospective cohort investigation using sequential sampling. Patients 16–45 years of age with isolated ACL rupture underwent all-inside ACL reconstruction using either semitendinosus of hamstring tendon or a combination of semitendinosus and gracilis tendon autografts between December 2021 and May 2022. They participated in the phase II rehabilitation program for follow-up and were eligible for inclusion. An isolated ACL rupture was diagnosed based on anamnesis, physical examination, and magnetic resonance imaging of the damaged knee. We eliminated cases of ACL reconstruction, ACL rupture with concomitant injury (multiple ligament injuries, cartilage defect, meniscal injury, fracture around the knee), lower extremity pathology, and aberrant contralateral knee joint. Twenty individuals were available for evaluation and were separated into two groups (10 all inside, 10 transportal).

2.2. Surgery procedure

One knee specialist did the entire arthroscopic operation. Under regional anesthetic, the patients were positioned supine, and a tourniquet was applied to the thigh and inflated without elevation or exsanguination. Initial diagnostic arthroscopy for ACL rupture was followed by graft harvesting (semitendinosus only in all inside and gracilis with semitendinosus in transportal).

Graft harvesting for the All-inside approach was performed via a normal 1.5–2 cm tibial incision created between the tibial tubercle and the medial edge of the tibia. An arthroscopic cannulated drill capable of both antegrade and retrograde drilling. A reverse-threaded guiding pin inserted into the proximal tibia allowed the Retrocutter device to be assembled intra-articularly. The requirement for high anteromedial portal drilling was minimized by creating the tibial socket from the inside out. After the passage of the graft through the anteromedial portal, an antegrade interference screw was utilized on the femoral side, and a retrograde interference screw was utilized on the tibial side. Suspensory button fixation and interference screw fixation were the fixation techniques used. For femoral fixation, BPTB grafts were fixed with interference screw fixation, whereas soft tissue grafts were fixed with either suspensory fixation or interference screw fixation. For tibial fixation of BPTB grafts, interference screw fixation was utilized, whilst suspensory fixation or interference screw fixation was utilized for soft tissue grafts.

2.3. Rehabilitation and follow up assessment

Five phases of identical rehabilitation therapy were administered to both groups of patients.

Phase I (weeks 1–2) includes partial weight-bearing and a full range of motion within 14 days.
Phase II (weeks 3–6) focuses on quadriceps and hamstring strengthening.
Phase III (6–12 weeks): proprioceptive exercise
Phase IV (weeks 12–20): Initial sport participation
Phase V (20–24 weeks): the return to sport.

A phase II rehabilitation program follow-up evaluation was undertaken to allow the surgical wound sufficient time to heal. The evaluation consisted of anamnesis and a physical examination to determine the presence of pain and crepitus. Both groups were then asked to complete the Indonesian version of the Kujala Anterior Knee Pain Scale, also known as the Kujala score, which is a patient-reported evaluation of patellofemoral pathology based on symptoms and functional limitation and consists of 13 questions [13]. The responses were added to yield a total score between 0 and 105, where 105 indicates no pain or limitation. Validity and reliability of the Indonesian version of the Kujala score for assessing patellofemoral pain have been documented [14].

2.4. Statistical analysis

Depending on the data distribution, the Mann-Whitney test or independent sample *t*-test was used to compare the period between operation and evaluation and the Kujala score between all-inside and transportal. The linear regression test was conducted to determine the relationship between the number of times the Kujala Score was calculated and the Kujala Score. All analyses were carried out using IBM SPSS Statistics 25 for Windows.

3. Result

Of the 20 subjects evaluated, 15 (75%) are males, and 5 (25%) are females. Ten (50%) subjects had an inside ACL reconstruction, and another ten subjects had a Transportal ACL Reconstruction. The Kujala Score mean of each group (1 = All Inside; 2 = Transportal) was depicted in Table 1.

Table 2 compares Kujala Score between All Inside and Transportal groups. No significant difference was noted in both group ($p = 0.809$).

Tables 3 and 4 showed the correlation between the time of surgery to evaluation and Kujala Score in each group (All inside and Transportal, respectively). Both tables showed a strong correlation between time of surgery to evaluation and Kujala Score (R Square = 0.942 and 0.910, respectively).

Table 1
Mean of kujala score in all inside and transportal ACL reconstruction.

Group Statistics					
	techgroup	N	Mean	Std. Deviation	Std. Error Mean
kujalascore	1	10	87.70	12.111	3.830
	2	10	91.40	13.672	4.324

Table 2
Independent *t*-test Showed Comparison of Kujala Score in All Inside and Transportal ACL Reconstruction.

Independent Samples Test			
		Levene's Test for Equality of Variances	
		F	Sig.
Kujala Score	Equal variances assumed Equal variances not assumed	.060	.809

Table 3
Correlation between time of surgery to evaluation and kujala score in all inside ACL reconstruction.

Model Summary				
Model	R techgroup = 1 (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	.971[a]	.942	.935	3.089

[a] Predictors: (Constant), weekpostop.

Table 4
Correlation between time of surgery to evaluation and kujala score in transportal ACL reconstruction.

Model Summary				
Model	R techgroup = 2 (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	.954[a]	.910	.898	4.356

[a] Predictors: (Constant), weekpostop.

4. Discussion

A systematic review comparing the All-inside and transportal techniques found no significant differences in post-operative functional outcomes between the two techniques. These findings are similar to our results. In contrast, the VAS pain score in the All-inside group was much lower than in the Transportal group. In addition, the aggregated rates of complications across all investigations were comparable between the two groups (AIT: 54 patients, 8.26% versus PT: 55 patients, 6.66%). However, in the four studies that prospectively evaluated All-inside and Transportal methods, the All-inside group saw fewer problems.

The literature study revealed no significant differences between the All-inside and Transportal groups regarding post-operative functional results. In studies directly comparing the two approaches prospectively, post-operative VAS pain levels and complication rates were lower in the All-inside group compared to the Transportal group, showing that All-inside is a good alternative strategy, particularly for treating athletes with an ACL injury [15–17].

5. Conclusion

There are no differences in functional outcomes and patellofemoral problems between gracilis sparing and gracilis sacrificing as the surgery technique options for ACL injury.

Sources of funding

This study did not receive any specific grant from funding agencies, commercial, or not-for-profit sectors.

Author contribution

Krisna Yuarno Phatama: conceptualization, writing original draft preparation, supervision, validation, data interpretation Edi Mustamsir: writing the paper and review, data interpretation, validation, supervision Aryc Oktarian Jaya: writing the paper and editing, data collecting, data interpretation, validation Ananto Satya Pradana: writing the paper and review, data interpretation, methodology Domy Pradana Putra: writing the paper and review, data interpretation, methodology, Mohamad Hidayat: writing the paper and review, validation, supervision.

Registration of research studies

1. Name of the registry:
2. Unique Identifying number or registration ID:
3. Hyperlink to your specific registration (must be publicly accessible and will be checked):

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Declaration of competing interest

We declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2022.104940.

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