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All-inside arthroscopic anterior cruciate ligament reconstruction with internal brace Ligament Augmentation using semitendinosus tendon autograft: A case series



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ABSTRACT

Introduction and importance: Anterior Cruciate Ligament (ACL) reconstruction surgery has been proven to be closely related to the graft healing process, which can last up to 12 months after surgery. In recent years, through various biomechanical and clinical studies, Internal Brace Ligament Augmentation (IBLA) has been shown to protect the graft during these early postoperative stages and improve the outcome of ACL reconstruction. We present this case series of all-inside arthroscopic anterior cruciate ligament reconstruction with IBLA using semitendinosus tendon autografts, with the goal of evaluating post-operative clinical and patient-reported outcomes.

Case presentation: A total of 37 patients who underwent all-inside arthroscopic anterior cruciate ligament reconstruction with IBLA using only semitendinosus tendon autografts, were evaluated, in terms of patient reported outcome and clinical assessment, during the 3, 6 and 12 months post-operative follow-up. Results: The mean Lysholm Knee score at the final follow-up was 94,03 \pm 3,65 with a difference of 34,59 \pm 5,52 to the baseline level. International Knee Documentation Committee (IKDC) classification rated 30 cases of grade A and 7 cases of grade B. In terms of clinical tests and knee's range of motion, all patients have returned to normal, and no cases of re-rupture or other severe complications were found. **Clinical discussion:** Early follow-up patient reported outcomes have provided good to great results for the 37 patients who underwent all-inside arthroscopic anterior cruciate ligament reconstruction with IBLA using semitendinosus tendon autografts and no cases of graft failure or other notable complication has been discovered. Clinical findings suggest improved knee's integrity and range of movement during the early stages, which may promote early rehabilitation, however future long-term comparative studies are needed.

Conclusion: IBLA with all-inside ACL reconstructions using only semitendinosus autograft has provided good to great results however, future long-term comparative studies are needed.

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1. Introduction

Anterior Cruciate Ligament (ACL) tear is a common injury caused by sports accidents or other knee injuries, with little distinction between regions and countries, prevalent among

working-age patients. Traditional literature has generally supported ACL reconstruction over ACL repair, considering it to be the current 'gold standard' treatment for an ACL tear.¹ The result of ACL reconstruction surgery has been proven to be closely related to the graft healing process, when the graft grows, assimilates into the bone to form a new ligament, and thereupon, can perform its designated biomechanical function, which can last up to 12 months after surgery.² Through several animal and in vivo models, it is reported that during this period, the graft will go under intensive

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remodeling and revascularization, while also being constantly elongated caused by the knee joint's movement, which decreases its tension, and consequently, reducing the function of the new ligament itself.^{3,4} In order to limit this phenomenon, suture augmentation has been developed and studied in biomechanical models and clinical settings, such as the technique of Internal Brace Ligament Augmentation (Arthrex), which has shown improvements in terms of early postoperative healing.^{3,4} A high strength suture tape is added to serve as a "safety belt" to share the load for the graft, which in theory, due to its structural support, can help reduce re-tear rate and improve knee function during this early stage, potentially improving the overall surgical outcome for patients. A Biomechanical study on porcine knees by Lai et al. suggests suture augmentation may confer improved integrity of the graft, especially in the ligamentization phase and is worth consideration for future clinical study.⁴ In 2019, Bachmaier et al. proposed that internal Suture Tape decreases the risk of graft tears, particularly in the case of small diameter soft tissue grafts.³ Several authors have applied internal suture augmentation with the goal of protecting the graft in ACL reconstruction, using either allograft or autograft.⁵ In cases of allograft, the graft healing process is longer than that of the autograft, therefore, using allograft reduces the new ligament's ability to bear the tensile force caused by the knee joint's movement. As a result, the failure rate of allograft ligament reconstruction is higher than in the autograft group, especially in younger patients with high levels of physical activity, which requires an earlier and more secure rehabilitation.⁶ The technique has been proposed to protect the graft in graft healing stage, promoting earlier and more secure rehabilitation, which is potentially advantageous for active patients and patients with smaller graft diameter.⁷ However, the application of this technique on a broader scale in clinical settings has been insufficient. Based on the foregoing history of this technique, we present this case series of all-inside arthroscopic anterior cruciate ligament reconstruction with Internal Brace using only the semitendinosus tendon autografts, with the goal of evaluating postoperative clinical and patient-reported outcomes.

2. Patients & method

2.1. Research design & patient selection

Every patient with anterior cruciate ligament injury who was assigned to have an All-inside single bundle anterior cruciate ligament reconstruction surgery with InternalBrace (Arthrex, Naples, Florida, US.) using only semitendinosus autograft without the gracilis tendon, smaller than 8 mm in diameter at Viet Duc Hospital between May 2020 and January 2021 were included in this single-center case series. Patients selection criteria includes clinical and imaging studies diagnosis of ACL injury, who were eligible to undergo the procedure. Furthermore, only patients within the range of age from 18 to 50, who are contactable and able to carry on a minimum follow-up time of 12 months, can be included in the study. Exclusion criteria consists of multi-ligament injury, previous bone or articular cartilage injuries, contralateral leg injury, limited range of motion as well as patients who did not consent to participate in the study. Overall, 37 patients were eligible, of which all of these patients were able to take part in the 3 months, 6 months and 12 months post-operative follow-up assessments.

2.2. Surgical technique

All surgeries were all-inside ACL reconstructions performed by our senior authors, following the same arthroscopic procedure.

Graft preparation followed the GraftLink (Arthrex) technique.⁸

The patients' ipsilateral semitendinosus grafts were harvested using a tendon stripper, through a 1.5–2 cm incision following the tibial tuberosity, to serve as the autograft for our reconstruction procedure. The harvested autograft has to be removed of excess muscle tissue and quadrupled, while ensuring the average length of 6 cm (the shortest being 5.5 cm) and the diameter of 7–8 cm. The collagen-coated FiberTape was looped to the TightRope RT (Arthrex) suspensory button which would later serve as the fixation on the femoral side. Fixation on the tibial side would likewise be another TightRope RT with a suspensory button. The two TightRope free ends were then attached on to two ends the quadrupled autograft using non-dissolvable stitches, on a graft-preparation station, serving as suspensory fixation with the FiberTape looped and fixed to the femoral suspensory button and parallel to the autograft. The graft and TightRope system were tensioned at 50–60 N for 10 min to eliminate creep.

Through the anteromedial and anterolateral portal, the injured knee structure was examined. Intraoperative findings, particularly associated injury diagnosis, autograft length and diameter and surgery duration, were taken into account. Any associated meniscal tears, which were confirmed during our arthroscopic procedures, were evaluated, classified based on their characteristics, and treated accordingly.

Our All-inside ACL reconstruction followed the procedure described by Lubowitz.⁹ The two sockets were drilled, through the original ACL insertion sites on the femoral condyle and tibial plateau, based on graft length and diameter, using the FlipCutter (Arthrex). After each socket creation, a looped TigerWire is passed through the sockets from outside, to serve as the passing sutures. The proximal TightRope with the FiberTape looped to the suspensory button is pulled to the femoral socket via the TigerWire passing suture (*Image 1a-b*).

Once the femoral button advanced out the femur, it is flipped and locked outside which would fixate the TightRope system to the femoral socket. The shortening sutures were alternatively pulled to ensure equal tension. The other TightRope and the FiberTape free end were subsequently passed through the passing suture loop and pulled into the tibial socket (*Image 1c*). The exited distal TightRope end was locked into place using its suspensory button, and after cycling the knee several time, the TightRope was tightened to stretch the graft, in a 30-degree flexion knee position. (*Image 1d*).

Afterwards, the FiberTape was stretched and fixed to the tibia at a position about 1–1.5 cm below the tibial socket with a 4.75 mm Bio-composite SwiveLock (Arthrex) (*Image 1e-f*). Most importantly, the FiberTape must be tensioned independently from the graft and the TightRope system. As a result, a hemostat or a electric scapel must be placed between the FiberTape and the tibia, not letting the FiberTape to get caught between the suspensory button and the tibia. To ensure that the FiberTape internal brace is not overstretched leading to limited knee, when fixing the FiberTape to the tibia, the knee must be placed in the hyperextension position. Finally, the knee should be checked, in terms of range of motion, graft tension and FiberTape tension, so that it creates a similar tension constructs.

Afterwards, the FiberTape was stretched and fixed to the tibia at a position about 1–1.5 cm below the tibial socket with a 4.75 mm Bio-composite SwiveLock (Arthrex).

2.3. Postoperative management

After the surgeries, patients were instructed to perform rehabilitation according to our pre-scheduled program. During the first four weeks, patients have to wear Orber knee braces and practice some hamstring and quadriceps exercises. Jogging and cycling are allowed after 10 weeks, with the combination of muscle and

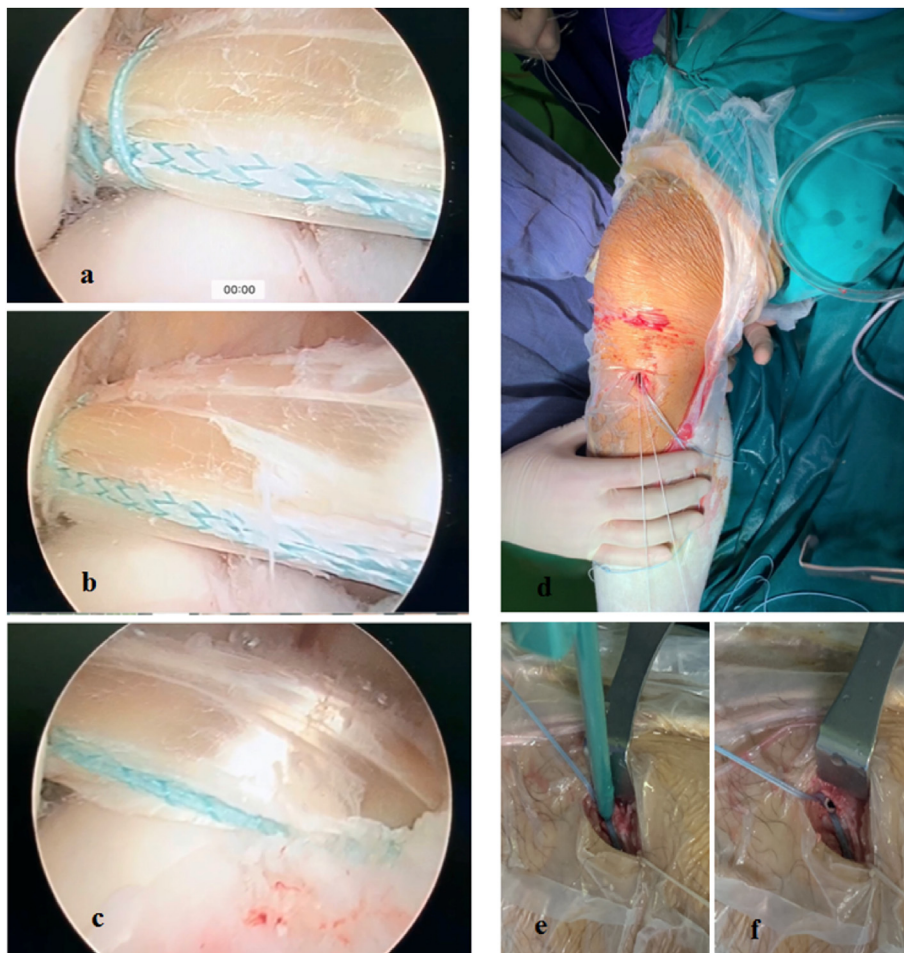


Image 1. Positioning of the autograft and the FiberTape into the femoral socket and tibial socket (Image 1a-b-c); Tensioning of the autograft using the TightRope (Image 1d); FiberTape fixation using the SwiveLock (Image 1e-f).

balance exercises for the next 5 weeks. Patients can return to everyday activities and sports at the 6th month after surgery. During their rehabilitation procedure, 37 patients (100%) attended our post-operative follow-up appointments of 3 months, 6 months and 12 months, without exception, in order to evaluate the clinical results.

2.4. Clinical evaluation

Lachman's test, anterior drawer test, Pivot shift test, and knee range of motion were used to confirm the patients' joint instability pre-operatively. These clinical examinations were performed additionally during their postoperative follow-up appointments at 3 months, 6 months, and 12 months, as well as the detection of other signs of possible postoperative complications. Subjective evaluations were obtained using patient-reported outcome scores (Lysholm Knee Score and International Knee Documentation Committee Score), in order to assess the clinical outcomes of these patients.

2.5. Statistical analysis

Mean and standard deviation were taken into account. When comparing differences between clinical outcomes and different factors, we used the Chi-squared test, which is considered statistically significant when $p < 0.05$. Independent results were

analyzed via 95% confidence interval. All of our analyses were performed using the SPSS 20.0 software.

2.6. Ethical issues in research

The patients participating in the study were randomly selected in the community, ensuring patient confidentiality. These patients were all contacted and informed about the purpose of the study as well as the examinations and various tests, which are to be performed. After being explained and consulted about the research goals, the patients who came to the clinic for follow-up examinations were voluntary and were examined at the hospital in accordance with what they had been consulted before coming to the clinic. The increased cost of surgical equipment are covered by insurance, therefore our study only includes patients with health insurance. This study, involving human subjects and human data, has been performed in accordance with the Declaration of Helsinki and has been approved by the Ethics Committee at the Hanoi Medical University, Hanoi, Vietnam, on March 2020.

3. Results

All 37 patients, 9 female and 28 male, who underwent all-inside single bundle anterior cruciate ligament reconstruction with Internal Brace suture augmentation using only semitendinosus autografts were able to participate in the 3, 6, and 12 month follow-up

evaluations. During the course of the study, no cases of re-rupture or other notable postoperative complications were discovered. However, one case reported slight knee squeaking, yet the sound was minor and the patients' knee function were unaffected. As a result, treatment for this case is not needed. The age of the patients ranged from 19 to 48 years old, with an average of 33 ± 7.84 years. In 20 patients (54.1%), ACL injury happened during sports, 11 cases (29.7%) were due to traffic accidents and 6 cases were other low energy traumas. (Table 1). 19 patients were operated less than 3 months after the injuries, while the other 18 patients had an elapsed time of over 3 months, with the mean elapsed time of 4.55 ± 3.84 months. The mean autograft length was 59.65 ± 1.90 cm, with the minimum mark being 55 mm. In addition, the harvested graft diameter ranged from 7 to 8 cm, with a mean of 7.51 ± 0.34 . Furthermore, in one case, we had to re-drill the inside tibial tunnel during the procedure since the graft could not be pulled out to the tibial plateau due to insufficient tunnel width.

Associated meniscal injuries were observed in 26 patients (70.27%), including 16 cases with medial meniscal tear, 6 cases with lateral meniscal tear, and 4 cases with both meniscus tears. The diagnosed injuries were treated accordingly during the arthroscopic procedure.

All 37 patients (100%) presented the symptom of knee laxity before the surgery. Clinical tests, including Lachman's test, Anterior Drawer test, Pivot Shift test, were performed and classified (Table 2), which revealed that at 6-month follow-up, 34 patients (91.9%) had reverted to normal in these categories, with the other 3 cases rated as grade 1. All 37 patients have returned to normal for these tests at the 12 months follow-up. The difference between preoperative and postoperative results were statistically significant.

Patients' knee range of motion were also taken into account. At the preoperative mark, 32 patients exhibited normal range of motion. After 1 year, at the final follow-up, all 37 patients have returned to normalcy (Tables 3 and 4). In fact, most patients' return to sport or work time ranges from 6 to 9 months, with no major complications recorded during the rehabilitation period.

The Lysholm score and IKDC classification were collected as the subjective post-operative outcome for the patients. At the 6 months follow-up, the Lysholm Knee score was 91.86 ± 4.80 (Table 5), which is regarded as good, with a mean difference of 32.43 ± 5.93 pre-postoperatively. These outcomes also exceeded the minimal clinically important difference (MCID) and patient acceptable symptom state (PASS) thresholds at their timespan, respectively.¹⁰ The mean Lysholm Knee score at the final follow-up was 94.03 ± 3.65 , with 24 cases (64.8%) graded as great and 13 cases (35.2%) as good. The difference between the baseline and the follow-up results were statistically significant.

According to Table 6, before the surgery, 19 cases had an IKDC classification of C while the remaining 18 were classified as D. At the final follow-up of 1 year, among the 37 patients, 30 patients (81.1%) were graded IKDC A, 7 (21.6%) were graded IKDC B and no cases of grade C or D was found. Furthermore, the difference between preoperative and postoperative gradings were statistically significant.

Table 1
Patients baseline data.

Age, year, mean \pm SD	33 ± 7.84
Sex, male/total, n (%)	28/37 (75.7)
Injury cause, n (%)	
Sports	20 (54.1)
Traffic accidents	11 (29.7)
Other	6 (16.2)

4. Discussion

Our objective for this case series is to evaluate postoperative clinical and patient-reported outcomes, particularly at the short-term follow-up, for the 37 patients undergoing all-inside arthroscopic anterior cruciate ligament reconstruction with IBLA using semitendinosus tendon autografts. Our results recorded good to great results for the patients, in terms of patient reported outcomes. The mean postoperative Lysholm Knee score after 1 year has reached 94.03 ± 3.65 (ranging from 86 to 98), with 24 cases (64.8%) graded as great and 13 cases (35.2%) as good, which is comparable to other all-inside ACL reconstruction study findings. A recently published study on 44 patients by Kyriakopoulos et al. comparing all-inside ACL reconstruction to the traditional semitendinosus-gracilis autograft has provided Lysholm score outcomes of 86.13 and 87 respectively, at the 24-month follow-up, which is comparable to our outcome at the 3-month follow-up at 89.35 ± 4.34 (Table 5).¹¹ Another study conducted on 53 patients by Pautasso et al. has revealed a Lysholm score of 92.4 ± 12.9 after 2 years of surgery. In fact, our study performed a similar technique (GrafLink and TightRope, Arthrex, Naples, Florida, US.) for the semitendinosus autograft, with the added FiberTape (Arthrex, Naples, Florida, US.).¹² While various ACL injury treatments have been studied and utilized for a long time, it is of recent years that suture augmentation has been explored and applied in biomechanical models. In 2017, a study by Bachmaier et al. has revealed that independent suture tape can potentially reduce re-rupture rate for ACL reconstruction without stress-shielding the soft tissue graft, especially in cases with small graft diameter, which needs to be further studied in clinical settings.³ In 2020, a technical note from Aboalata et al. described a detailed arthroscopic procedure of suture augmentation for ACL reconstruction, where the technique was proposed to allow early rehabilitation and return to sports after anterior cruciate ligament reconstruction (ACLR) and may be advantageous in cases with small grafts.⁷ Our initial clinical assessments discovered related outcomes to that of these authors, as no case of re-rupture was found, all patients joined an active rehabilitation program after surgery, and finally, most patients returned to sport or work after 6–9 months. This may be beneficial for highly active individuals who participate in various sport activities, particularly athletes. Additionally, one patient reported slight creaking knee sound. This complication has been noted in a case report following ACL reconstruction using FiberWire (Arthrex).¹³ However, in our case, the physical knee function was not affected, the sound was subtle and tolerable to the patient. Moreover, the patient has reported a return to sport time of 6 months. As a result, treatment for this complication was not necessary.

The main focus of this technique is to provide a load sharing suture tape to function as a "safety belt" for the new graft during the graft healing process, when the graft will undergo extensive remodeling and vascularization, followed by the ligamentization phase, which can last up to 12 months postoperatively.² During these phases, the autograft suffers from constant elongation and mobility from the knee, further reducing its biomechanical capabilities to bear the tensile force, which is why the graft needs structural support, especially during the 12 months postoperative period.² A Biomechanical study on porcine knees by Lai et al. suggests Suture Augmentation may confer improved integrity of the graft, especially in the ligamentization phase and is worth consideration for future clinical study.⁴ Our clinical case series further confirms these findings, as both in terms of patient-reported outcome measures (PROMs) and clinical evaluation, the patients' knee integrity after the ligamentization phase (less than 12 months) have all improved significantly. As a matter of fact, all of the 37 patients presented to our center with a loose knee joint, but

Table 2
Stability according to Lachman Test, Anterior Drawer test and Pivot Shift Test.

Tests		Grade 0	Grade 1	Grade 2	Grade 3	Total	P-value
Lachman's test	Preoperative	0 (0%)	0 (0%)	10 (27%)	27 (73%)	37 (100%)	
	3 months	31 (83,8%)	3 (8,1%)	3 (8,1%)	0 (0%)	37 (100%)	<0,001
	6 months	34 (91,9%)	3 (8,1%)	0 (0%)	0 (0%)	37 (100%)	<0,001
	12 months	37 (100%)	0 (0%)	0 (0%)	0 (0%)	37 (100%)	<0,001
Anterior Drawer	Preoperative	0 (0%)	0 (0%)	6 (16,2%)	31 (83,8%)	37 (100%)	
	3 months	35 (94,6%)	1 (2,7%)	1 (2,7%)	0 (0%)	37 (100%)	<0,001
	6 months	36 (97,3%)	1 (2,7%)	0 (0%)	0 (0%)	37 (100%)	<0,001
	12 months	37 (100%)	0 (0%)	0 (0%)	0 (0%)	37 (100%)	<0,001
Pivot Shift	Preoperative	0 (0%)	0 (0%)	7 (18,9%)	30 (81,1%)	37 (100%)	
	3 months	32 (86,5%)	3 (8,1%)	2 (5,4%)	0 (0%)	37 (100%)	<0,001
	6 months	35 (94,6%)	2 (5,4)	0 (0%)	0 (0%)	37 (100%)	<0,001
	12 months	37 (100%)	0 (0%)	0 (0%)	0 (0%)	37 (100%)	<0,001

*Wilcoxon Signed Ranks Test.

Table 3
Knee extension before and after surgery.

Range of motion	Patient	Normal	Limited knee extension ≤5	Limited knee extension >5	Total
Pre-operative	(n = 37)	36 (97,3%)	1 (2,7%)	0 (0%)	37 (100%)
3 months	(n = 37)	36 (97,3%)	1 (2,7%)	0 (0%)	37 (100%)
6 months	(n = 37)	37 (100%)	0 (0%)	0 (0%)	37 (100%)
12 months	(n = 37)	15 (100%)	0 (0%)	0 (0%)	37 (100%)

Table 4
Knee flexion before and after surgery.

Range of motion	Patient	Normal	Limited knee flexion <10	Limited knee flexion 10-20	Limited knee flexion ≥ 20	Total
Pre-operative	(n = 37)	32 (86,5%)	4 (10,8%)	1 (2,7%)	0 (0%)	37 (100%)
3 months	(n = 37)	34 (91,9%)	3 (8,1%)	0 (0%)	0 (0%)	37 (100%)
6 months	(n = 37)	36 (97,3%)	1 (2,7%)	0 (0%)	0 (0%)	37 (100%)
12 months	(n = 37)	37 (100%)	0 (0%)	0 (0%)	0 (0%)	37 (100%)

Table 5
Lysholm scores before and after surgery.

Lysholm	Preoperative	3 months	6 months	12 months
Mean + -SD	59,43+- 4,44	89,35+- 4,34 ^a	91,86+- 4,80 ^a	94,03 +- 3,65 ^a
Difference		29,92 +- 2,61	32,43 +- 5,93	34,59 +- 5,52

^a Significant compared with preoperative value.

at the final follow-up, clinical tests revealed that all of 37 patients had reverted to normal in these categories. In addition, at the 6 months follow-up, only 1 case remained to have flexion loss of under 10°. However, the patients' injury to surgery time was 14 months, highest among all 37 patients, which may contribute to reduced knee's function and knee stiffness. The patient's knee range of motion had returned to normal at the final 12 months follow-up.

One key aspect to this study is that we used a quadrupled semitendinosus tendon, without the gracilis tendon, to serve as the autograft for the patients, with a mean graft diameter of 7,51 +- 0,34 (range, 7 to 8) mm, which is the most often utilized autograft

for the all-inside technique, instead of the larger traditional hamstring or bone-patellar tendon-bone autografts. A systematic review by de SA et al. has provided key findings to the all-inside technique, such as low graft failure rate. However, all of the failed cases were that of the semitendinosus autografts.¹⁴ For that reason, we performed this technique with the application of Internal Brace, which in theory, can help minimize graft failure rate, and improve rehabilitation for cases of ACL reconstruction using the semitendinosus tendon, without the gracilis tendon. The application of a small size tendon graft may propose another added benefit of saving the other part of the hamstring tendon, further preserving the original knee's function. The Internal Brace method has been mainly applied to protect the anastomosis in cases of tendon suture of the ankle ligaments, the medial collateral ligament and in this case series, the anterior cruciate ligaments of the knee joint.¹⁵ Current literature on this matter has been primarily focusing on ACL repair, which has been disregarded in the past due to its unsatisfactory follow-up outcomes, instead of ACL reconstruction. Several studies have demonstrated the benefit of Internal Brace when applied with ACL repair, which is even comparable to

Table 6
IKDC grade before and after surgery.

	Classification	Great (A) n (%)	Good (B) n (%)	Average (C) n (%)	Bad (D) n (%)	p-value
	Time					
IKCD	Preoperative	0	0	19 (51,4%)	18 (48,6%)	
	3 months	24 (64,9%)	10 (27,0%)	3 (8,1%)	0	<0,001
	6 months	28 (75,7%)	8 (21,6%)	1 (2,7%)	0	<0,001
	12 months	30 (81,1%)	7 (18,9%)	0	0	<0,001

standard ACL reconstruction.¹⁶ Particularly, a study on 56 patients by Jonkergouw et al. on ACL repair with or without Internal Brace after 3.2 years of follow-up collected a mean Lysholm Knee score of 93.0 ± 7.9 for the latter group.¹⁷ Moreover, cases of re-rupture and other postoperative complications were still apparent.^{17–19} Based on that account, more studies should be performed, not just only on ACL repair, but also ACL reconstruction and the benefits of internal suture tape for these techniques. After this case series, a randomized controlled study with a larger sample size should be performed, on patients undergoing ACL reconstruction with and without suture tape, with a long-term follow-up period, in order to precisely identify the overall benefits of suture augmentation to patients' subjective and objective outcomes. In addition, as there are various outcomes for meniscal tear treatment, a comparison between meniscectomy and meniscal repair, in terms of ACL reconstruction with suture tape should be performed and evaluated.²⁰

5. Conclusion

Early follow-up patient reported outcomes have provided good to great results while clinical findings suggest improved knee's integrity and range of motion for the 37 patients who underwent all-inside arthroscopic anterior cruciate ligament reconstruction with internal suture augmentation, with no cases of graft failure or other major complications have been discovered. Implementation of suture augmentation in ACL reconstructions may provide a viable treatment for injured ACL patients with small diameter graft or highly active patients, particularly athletes, however, future long-term comparative studies are needed.

5.1. New findings

- Early follow-up patient reported outcomes have provided good to great results for patients who underwent all-inside arthroscopic anterior cruciate ligament reconstruction with Internal-Brace Ligament Augmentation, with no cases of graft failure discovered.
- Clinical findings suggest improved knee's integrity and range of movement during the early stages, which may promote rehabilitation, however preoperative rehabilitation details and long-term assessments are needed.
- InternalBrace Ligament Augmentation may provide a viable treatment for injured ACL patients with small diameter graft or highly active patients, particularly athletes.
- This case series provided preliminary results, which will be beneficial for studies in the future concerning suture augmentation for ACL reconstructions.

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We declare no funding for this study.

Ethical approval

The procedures used in this study inhere to the tenets of the Declarations of Helsinki.

Consent

We introduced the patient to sign informed consent and attached the manuscript.

Author statement

DTT: operating, performing surgery, editing and being responsible for publishing.

TDD, SML, TTN, BNTD, HHL: contributed: assisting with surgery, collecting data, analyzing, and interpreting, drafting the manuscript.

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Declaration of competing interest

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

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