ORIGINAL ARTICLE

Comparing clinical and functional outcomes of anterior cruciate ligament reconstruction using sonoelastography

Eralp Erdogan,[1] Zafer Gunes,[1] Ozgur Kaya,[2] Mehmet Hamdi Sahan,[3] Veysel Burulday,[4] Özge Vergili,[5] Sancar Serbest,[6] Ugur Tiftikci[1]

[1]Department of Orthopedics and Traumatology, Ankara Training and Research Hospital, Ankara-*Türkiye*

[2]Department of Orthopedics and Traumatology, Liv Hospital, Ankara-*Türkiye*

[3]Department of Radiology, Gaziantep University Faculty of Medicine, Gaziantep-*Türkiye*

[4]Department of Radiology, Inonu University Faculty of Medicine, Malatya-*Türkiye*

[5]Department of Physiotherapy And Rehabilitation, Kırıkkale University Faculty of Health Science, Kırıkkale-*Türkiye*

[6]Department of Orthopedics And Traumatology, Kırıkkale University Faculty of Medicine, Kırıkkale-*Türkiye*

ABSTRACT

BACKGROUND: Injuries to the anterior cruciate ligament (ACL) are prevalent, particularly following athletic incidents. Most clinicians use MRI for diagnostic purposes and therapy assessment, but it can present challenges in terms of cost and accessibility. While ultrasound guidance (USG) is more readily available, it is inadequate for diagnosing ACL injury in isolation. Therefore, our study aimed to evaluate the effectiveness of sonoelastography, a novel method for assessing tendon injuries, in the context of anterior cruciate ligament (ACL) injuries.

METHODS: This study involved a cohort of 45 patients who fulfilled the designated inclusion criteria. We selected the patients from a cohort of 105 individuals who underwent anatomical ACL restoration at the orthopedics and traumatology clinic between 2017 and 2020. The clinical examination results and the stability and quality of the ACL in patients who underwent ACL reconstruction were compared with those from magnetic resonance imaging (MRI) and stress echo laxity (SEL) testing.

RESULTS: The study comprised 40 individuals with a mean age of 30.7±1.4 years. The patients' Lysholm scores exhibited considerable enhancement post-operation, with a mean increase from 2.2±0.9 pre-operation to 6.1±1.6 post-operation. The Lachman, anterior drawer, and pivot-shift tests demonstrated improvements relative to the preoperative values. No substantial difference was observed in the single-leg hop test relative to the unaffected side. The SEL findings indicated that 15.6% of the healthy ACL instances were categorized as type 2a, 68.9% as type 2b, and 15.6% as type 3a. In the reconstructed ACL cohort, 17.8% were categorized as type 2a, 62.2% as type 2b, and 20% as type 3a. No substantial statistical difference was detected between the healthy ACL and the reconstructed ACL. No occurrences of type 3b or type 4 were identified in any of the patients.

CONCLUSION: We used SEL to find a torn ACL and check its stability and condition after the ligament was reconstructed with a graft. We utilize SEL, or stress sonoelastography, to monitor graft viability and evaluate the progression of ACL injuries. It is also beneficial in evaluating whether the restored ligament possesses a functional structure akin to that of a normal ligament. Moreover, considering its accessibility, cost-effectiveness, replicability, and patient preference, it may provide a more advantageous alternative to MRI.

Keywords: ACL reconstruction; ACL rupture; sonoelastography; ultrasound.

Cite this article as: Erdogan E, Gunes Z, Kaya O, Sahan MH, Burulday V, Vergili Ö, et al. Comparing clinical and functional outcomes of anterior cruciate ligament reconstruction using sonoelastography. Ulus Travma Acil Cerrahi Derg 2025;31:1088-1094.

Address for correspondence: Eralp Erdogan

Department of Orthopedics and Traumatology, Ankara Training and Research Hospital, Ankara, Türkiye

E-mail: eralperdogan85@hotmail.com

Ulus Travma Acil Cerrahi Derg 2025;31(11):1088-1094 DOI: 10.14744/tjtes.2025.73730

Submitted: 10.02.2025 Revised: 29.09.2025 Accepted: 03.10.2025 Published: 03.11.2025

OPEN ACCESS This is an open access article under the CC BY-NC license (http://creativecommons.org/licenses/by-nc/4.0/).

INTRODUCTION

Anterior cruciate ligament (ACL) injuries represent one of the most frequent clinical problems encountered in orthopedic surgery. Accurate diagnosis and timely initiation of appropriate treatment are critical to prevent progressive joint damage and functional deterioration of the knee joint.[1,2] Although magnetic resonance imaging (MRI) remains the gold standard in evaluating ACL pathology, ultrasonography (US) has gained increasing attention due to its accessibility, cost-effectiveness, and ability to allow real-time dynamic assessment in conjunction with clinical examination.[3] However, conventional US often demonstrates similar echogenicity between normal and pathological tissues, particularly in cases of tendinopathy, thereby limiting its diagnostic superiority over MRI.[4]

Magnetic resonance imaging (MRI) provides excellent soft-tissue contrast and multiplanar capability,[2] but its use is limited by high cost, reduced availability in some clinical settings, longer acquisition times, and contraindications such as metallic implants or claustrophobia.[3] In contrast, ultrasonography (US) offers a rapid, inexpensive, and readily accessible alternative that can be performed alongside dynamic physical examination.[5-7] However, US is highly operator-dependent, and conventional gray-scale imaging may fail to detect subtle changes in tissue integrity, especially in partial ligament tears or tendinopathy.[8] These limitations highlight the potential value of advanced US-based techniques, such as sonoelastography (SEL), which combine accessibility with objective biomechanical evaluation.

Sonoelastography (SEL) is a recently developed diagnostic technique that enables evaluation of tissue stiffness and mechanical integrity by measuring elasticity.[9,10] It has been increasingly applied in musculoskeletal practice to assess conditions such as Achilles tendinopathy, biceps tendinopathy, epicondylitis, plantar fasciitis, and muscle disorders.[8,11-13] Despite its expanding use, evidence regarding the application of SEL in ACL injuries is still limited. A review of the current literature reveals an absence of studies specifically addressing the use of SEL in postoperative ACL evaluation. Therefore, SEL may represent a valuable, objective, and reproducible method to assess graft integrity following ACL reconstruction.

The present study aims to evaluate graft integrity in comparison with the contralateral healthy ACL using SEL in patients undergoing ACL reconstruction with hamstring autografts. In addition, clinical and functional outcomes were assessed to determine the reliability of SEL in postoperative graft monitoring. We hypothesize that SEL can serve as a rapid and effective imaging modality to evaluate graft integrity during the postoperative follow-up period.

MATERIALS AND METHODS

This prospective study was approved by the Clinical Research Ethics Committee of Kırıkkale University Faculty of Medicine (approval number: 10/03, date: 27.04.2015) and conducted in accordance with the principles of the Declaration of Helsinki. All participants were thoroughly informed about the study protocol, and written informed consent was obtained from each patient. The study did not receive any external funding, and all expenses were personally covered by the investigators.

A total of 45 patients who met the inclusion criteria were enrolled from a larger cohort of 105 individuals who underwent anatomical ACL reconstruction in our Orthopedics and Traumatology Clinic between 2017 and 2020. The inclusion criteria were unilateral and isolated ACL rupture, ACL reconstruction performed with four-strand hamstring tendon autograft, presence of a healthy contralateral knee, absence of previous knee surgery, closed growth plates, and patient age younger than 40 years at the time of surgery. Exclusion criteria included fractures involving the knee joint surface, lower limb malalignment, history of knee surgery, systemic connective tissue disorders, and a follow-up period shorter than six months.

Baseline demographic characteristics were recorded, and clinical as well as functional assessments were performed both preoperatively and at the sixth postoperative month. These assessments included knee joint range of motion (ROM), Lachman test, anterior drawer test, pivot-shift test, Lysholm knee scoring system, Tegner activity score, thigh circumference measurements, and the single-leg hop test.

At the six-month follow-up, stress sonoelastography (SEL) examinations were conducted bilaterally, enabling comparative evaluation of reconstructed and contralateral ACL integrity. Correlations between SEL findings and clinical examination results were subsequently analyzed.

Sonoelastography Examination Protocol

All sonoelastography examinations were performed by either M.H.Ş. or V.B., both of whom had three years of experience in elastography and more than twelve years of expertise in conventional ultrasonography. A LOGIQ E9 system (GE Healthcare, Chicago, IL, USA) equipped with elastography software and a linear array probe (frequency range: 6–15 MHz, model 9L) was utilized.

Patients were examined in the supine position with the knee flexed to approximately 70-80°. The transducer was placed on the anterior aspect of the knee, slightly proximal to the tibial tuberosity, aligned with the patellar tendon (Figure 1). B-mode and elastographic images were displayed simultaneously in a split-screen mode. Gentle manual compression was applied using the transducer, and image acquisition was performed when the optimal compression level was achieved, as monitored by the on-screen compression bar.

Elastographic images were represented using a color-coded map corresponding to tissue stiffness: red (softest), green (in-

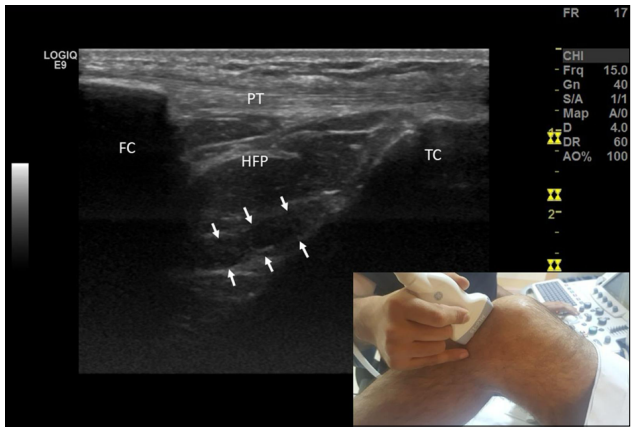


Figure 1. Longitudinal grayscale ultrasound image of the anterior cruciate ligament. The small inset image demonstrates the anatomical orientation of the transducer and knee position (FC: femoral condyle, TC: tibial condyle, PT: patellar tendon, HFP: Hoffa's fat pad).

Table 1. SEL color mapping of the ACL strain

Type 1	Hardest tissue	Mostly blue
Type 2a	Hard tissue	Blue-green (main color blue)
Type 2b	Hard tissue	Blue-green (main color green)
Type 3a	İntermediate tissue	Mostly Green (blue-green-yellow)
Type 3b	Intermediate tissue	Mostly Green (green-yellow)
Type 4	Soft tissue	Yellow-green-red

termediate), and blue (hardest) (Figure 2,3). ACL strain patterns were classified into three major categories with two additional subtypes (Table 1). Image interpretation was conducted independently by two radiologists, and consensus was reached for all cases.

Surgical Procedure

All patients received prophylactic intravenous antibiotics preoperatively. Surgeries were performed under regional anesthesia with patients in the supine position and a pneumatic tourniquet applied.

Anatomic ACL reconstruction was performed using a standard anteromedial portal technique with four-strand hamstring tendon autografts. Femoral fixation was achieved with a ToggleLoc ZipLoop endobutton system (Biomet Sports Medicine, Warsaw, IN, USA). Tibial fixation was accomplished using a biocomposite interference screw in combination with a staple (Biomet Sports Medicine). During fixation, the graft was tensioned with the knee maintained at 10°–20° of flexion.

Rehabilitation

Postoperative rehabilitation was initiated on the first postoperative day. Patients were instructed to achieve knee flexion of 30° within the first week, 60° by weeks 1–2, 90° by weeks 3–4, and up to 120° by weeks 4–6. A structured exercise program was implemented, focusing on quadriceps and hamstring strengthening, hip stabilization, and progressive range-of-motion exercises.

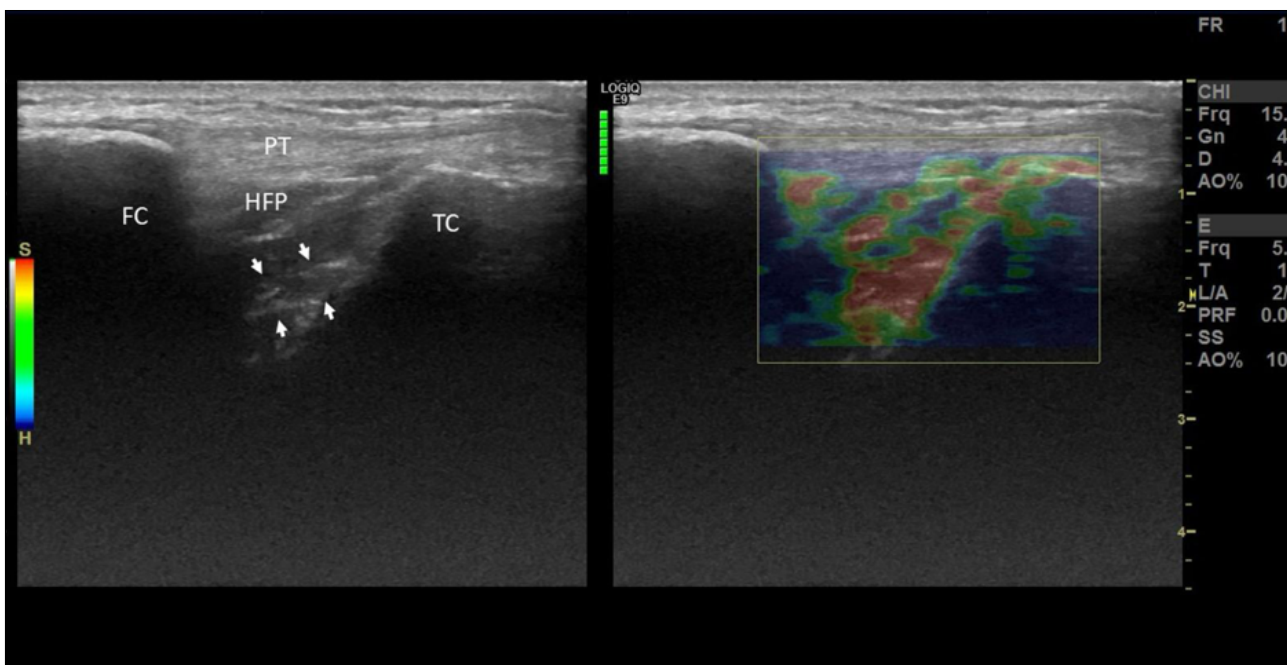


Figure 2. Preoperative longitudinal B-mode grayscale ultrasound and strain elastography images of the anterior cruciate ligament (FC: femoral condyle, TC: tibial condyle, PT: patellar tendon, HFP: Hoffa's fat pad).

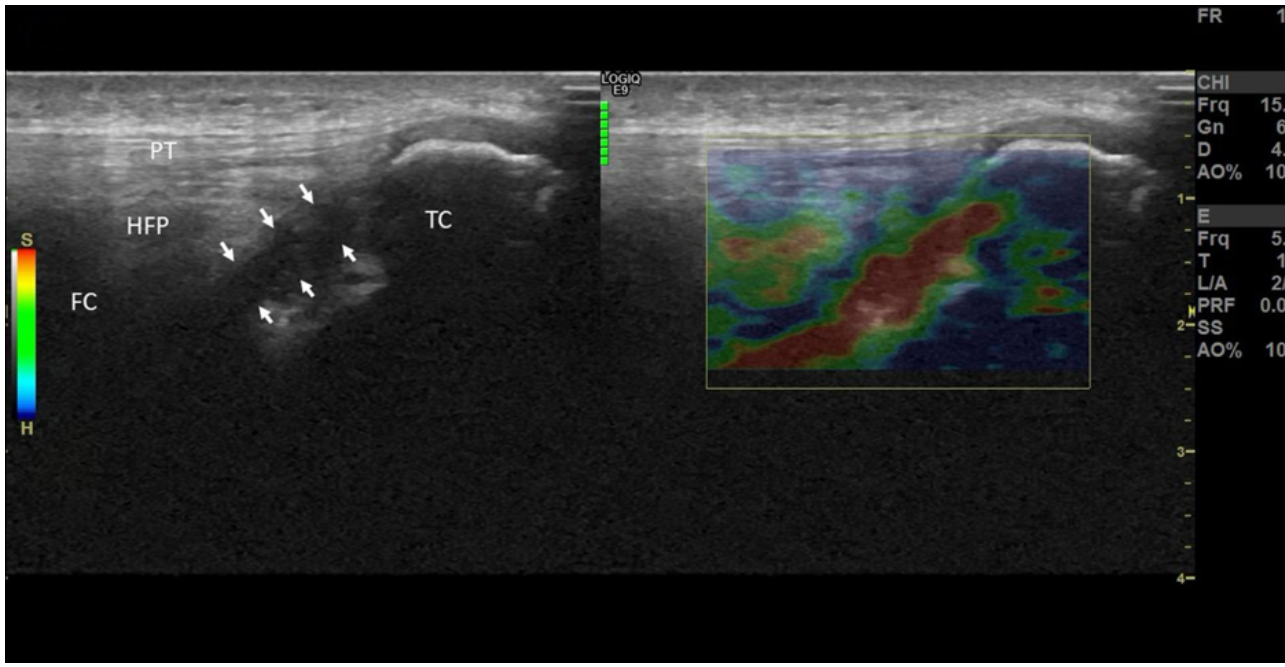


Figure 3. Postoperative longitudinal B-mode grayscale ultrasound and strain elastography images of the anterior cruciate ligament (FC: femoral condyle; TC: tibial condyle; PT: patellar tendon; HFP: Hoffa's fat pad).

The rehabilitation protocol included isometric and isotonic strengthening, progression from closed-chain to open-chain exercises, and hamstring stretching. Patients were encouraged to ambulate with crutches as tolerated and to discontinue crutch use once normal gait was achieved. Proprioceptive training and neuromuscular re-education exercises were gradually incorporated during the later phases of rehabilitation.

Statistical Analysis

Statistical analyses were performed using the chi-square test for categorical variables and paired Student's t-test for continuous variables. A p-value <0.05 was considered statistically significant. No formal sample size calculation was performed.

RESULTS

A total of 45 patients (40 males, 5 females) with a mean age of 30.7±1.4 years were included in the study. Clinical and functional outcomes were compared between the preoperative and postoperative periods.

The Lysholm knee score demonstrated significant improvement, increasing from a mean of 51.7±13.8 preoperatively to 91.0±8.4 postoperatively (p<0.001). Similarly, the Tegner activity score increased from 2.2 ± 0.9 before surgery to 6.1±1.6 after surgery (p<0.001). Clinical stability tests, including the Lachman, anterior drawer, and pivot-shift tests, also revealed significant improvement compared with preoperative findings (Table 2).

Functional evaluations demonstrated no statistically significant differences between the operated and contralateral healthy knees. The single-leg hop test showed comparable outcomes between both sides (p>0.05). Thigh circumference measurements indicated a slight increase on the uninjured side compared with the reconstructed side, though the difference was not statistically significant (Table 3).

Table 2. Functional and clinical findings of the patients

	Pre-op	Post-op	p
Lysholm score	51.7±13.8	91,0± 8.4	0.0001
Tegner activity score	2.2 ±0.9	6.1±1.6	0.0001
Lachman	(0/1/2/3)	0/19/22/4	40/4/0/0
Pivot shift	30	2	0.0001
Anterior drawe	(0/1/2/3)	0/14/26/5	37/8/0/0

Table 3. Clinical findings compared with the healthy side

	Operated side	Healhty side	p
Single leg jump score	114.2±17.5	106.2±21.6	0.19
Thigh diameter difference (average cm)	2.1±0.8	2.7±0.3	0.12

Table 4. SEL findings

	Type 2a	Type 2b	Type 3a
Reconstructed anterior cruciate ligament	8 (17.8 %)	28 (62.2 %)	9 (20%)
Intact anterior cruciate ligament	7 (15.6 %)	31 (68 %)	7 (15.6 %)

Stress sonoelastography (SEL) analysis of the contralateral healthy ACL demonstrated type 2a patterns in 15.6% (n=7), type 2b in 68.9% (n=31), and type 3a in 15.6% (n=7) of cases. On the reconstructed side, SEL revealed type 2a in 17.8% (n=8), type 2b in 62.2% (n=28), and type 3a in 20.0% (n=9) of cases (Table 4). The distribution of SEL classifications did not differ significantly between the reconstructed and healthy ACLs (p=0.189).

Notably, no cases demonstrated type 3b or type 4 SEL patterns. These findings suggest that postoperative graft integrity and biomechanical stability were generally comparable to those of the contralateral healthy ACL.

DISCUSSION

The present study demonstrates that sonoelastography (SEL) is a feasible and reliable method for evaluating graft quality and stability following anterior cruciate ligament (ACL) reconstruction. When compared with the contralateral healthy ligament, the reconstructed graft exhibited similar SEL patterns, suggesting that this modality provides objective information regarding graft integrity. These findings were corroborated by significant improvements in both clinical examination results and functional outcome measures.

Conventional clinical tests, such as the Lachman, anterior drawer, and pivot-shift, remain widely used in the diagnosis of ACL insufficiency. Nevertheless, these examinations are inherently subjective and may be influenced by examiner experience, pain, swelling, and muscle spasm.[1-3] Although the Lachman test has been reported as the most sensitive (85–98%) and specific (94%) method, variability remains a concern.[4,9,10] In this study, SEL findings demonstrated strong agreement with the results of these clinical tests, supporting its role as an objective adjunct in postoperative assessment of ACL grafts.

Our SEL analysis revealed that both the reconstructed and contralateral ACLs were most frequently classified as type 2 patterns, reflecting preserved elasticity and biomechanical stability. Importantly, no cases exhibited type 3b or type 4 SEL patterns, which are typically associated with impaired ligamentization and reduced structural integrity. These results indicate that the reconstructed grafts demonstrated maturation patterns comparable to the native ACL.

Magnetic resonance imaging (MRI) has traditionally been utilized to monitor graft maturation after ACL reconstruction, particularly through signal intensity and graft volume analysis.[14-18] However, MRI assessments are limited by variability in acquisition protocols, scanner differences, and subjective interpretation of signal-to-noise ratios. While MRI provides indirect information about vascularization and remodeling, it does not directly assess biomechanical properties such as stiffness and elasticity. In contrast, SEL offers real-time, dynamic, and reproducible measurements of tissue elasticity, thereby reflecting the functional mechanical status of the graft. Recent reports suggest that SEL may provide superior insight into graft elasticity and functional stability compared with MRI, although this hypothesis requires confirmation through prospective comparative studies.[19-21]

Several studies have investigated MRI as a tool for monitoring graft maturation after ACL reconstruction, focusing on changes in signal intensity and vascularization patterns.[14-18] While MRI provides valuable morphological information, its correlation with clinical outcomes and graft biomechanical strength remains inconsistent.[17,18] By contrast, SEL directly evaluates tissue elasticity, which is more closely related to the mechanical properties essential for knee stability. Emerging evidence suggests that SEL may detect early alterations in graft stiffness not apparent on MRI, thereby offering a more functionally relevant assessment of graft integrity.[19-21]

Previous investigations, including the study by Lutz et al., have shown that MRI can effectively monitor graft maturation fol-

lowing hamstring autograft reconstruction; however, correlations with clinical outcomes remain inconsistent.[17] Similarly, Yau and Chan recently highlighted that MRI can demonstrate ligamentization but may not reliably predict graft rupture or functional stability.[18] Our findings suggest that SEL, by directly assessing graft stiffness, may complement or even surpass MRI in postoperative evaluation.

The process of tendon-to-ligament transformation (ligamentization) after ACL reconstruction is central to long-term graft survival. MRI has been widely used to visualize this process, but its sensitivity in detecting mechanical deterioration is limited.[17,18] In our study, SEL demonstrated that reconstructed grafts retained mechanical properties comparable to the contralateral ACL, and none progressed to advanced degeneration. These observations suggest that SEL may be better suited to evaluate the biomechanical consequences of ligamentization than MRI.

Although there is limited literature on the use of SEL in ACL pathology, previous reports have described its application in posterior cruciate ligament evaluation,[19] patellar tendon donor site monitoring after ACL reconstruction,[20,21] and tendinopathy assessment.[8] Our study represents the first to demonstrate the feasibility of SEL in monitoring ACL graft integrity postoperatively, combining imaging with clinical and functional outcomes.

This study has several limitations that must be acknowledged. First, the relatively small sample size may have limited the statistical power to detect subtle differences in SEL classifications. Second, the follow-up duration of six months is relatively short for evaluating long-term graft maturation and functional outcomes. Previous studies have suggested that graft ligamentization and remodeling may continue for up to two years postoperatively;[17,18] therefore, extended follow-up is necessary to determine the predictive value of SEL. Third, direct comparison with MRI was not performed in this study. Although the literature suggests that MRI is the most widely accepted modality for postoperative graft evaluation, the absence of parallel MRI data restricted our ability to directly validate SEL findings. Future research incorporating both imaging modalities will be critical to clarify the comparative diagnostic performance of SEL.[16] Finally, the study design was limited to a single center, and all examinations were performed by experienced musculoskeletal radiologists. While this approach ensured consistency, it may limit the generalizability of our findings to less experienced practitioners or different clinical settings. Multicenter studies with broader operator variability are needed to confirm reproducibility.

In summary, our results indicate that SEL provides valuable, objective, and reproducible data on graft integrity following ACL reconstruction. Given its accessibility, cost-effectiveness, and ability to evaluate tissue elasticity in real time, SEL may serve as a practical alternative or complement to MRI in routine postoperative monitoring.

CONCLUSION

In this study, stress sonoelastography (SEL) was applied to evaluate graft integrity and biomechanical stability following anterior cruciate ligament (ACL) reconstruction with hamstring autografts. Our findings demonstrated that SEL patterns of reconstructed grafts were comparable to those of the contralateral native ACL, supporting its validity as a postoperative assessment tool.

SEL offers several advantages, including accessibility, cost-effectiveness, reproducibility, and the ability to provide dynamic and objective measurements of tissue elasticity. These features suggest that SEL may serve as a valuable adjunct, or even a practical alternative, to magnetic resonance imaging in the postoperative follow-up of ACL reconstruction.

Further studies with larger cohorts, longer follow-up periods, and direct comparisons with MRI are warranted to confirm the diagnostic and prognostic value of SEL in monitoring graft maturation and functional outcomes.

Ethics Committee Approval: This study was approved by the Kırıkkale University Faculty of Medicine Ethics Committee (Date: 27.04.2015, Decision No: 10/03).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: E.E.; Design: Z.G.; Supervision: O.K.; Resource: U.T.; Materials: E.E.; Data collection and/or processing: M.H.S.; Analysis and/or interpretation: V.B.; Literature review: O.V.; Writing: E.E., O.K., S.S.; Critical review: E.E., U.T., S.S., O.K.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

REFERENCES

1. Palm HG, Bergenthal G, Ehry P, Schwarz W, Schmidt R, Friemert B. Functional ultrasonography in the diagnosis of acute anterior cruciate ligament injuries: A field study. Knee 2009;16:441-6. [CrossRef]
2. Kam CK, Chee DW, Peh WC. Magnetic resonance imaging of cruciate ligament injuries of the knee. Can Assoc Radiol J 2010;61:80-9. [CrossRef]
3. Middleton WD, Payne WT, Teefey SA, Hildebolt CF, Rubin DA, Yamaguchi K. Sonography and MRI of the shoulder: comparison of patient satisfaction. AJR Am J Roentgenol 2004;183:1449-52. [CrossRef]
4. Lee SU, Joo SY, Kim SK, Lee SH, Park SR, Jeong C. Real-time sonoelastography in the diagnosis of rotator cuff tendinopathy. J Shoulder Elbow Surg 2016;25:723-9. [CrossRef]
5. Wang JH, Wu HY, Dong FJ, et al. The role of ultrasonography in the diagnosis of anterior cruciate ligament injury: a systematic review and meta-analysis. Eur J Sport Sci 2018;18:579-86. [CrossRef]
6. Lee SH, Yun SJ. Efficiency of knee ultrasound for diagnosing anterior cruciate ligament and posterior cruciate ligament injuries: a systematic review and meta-analysis. Skeletal Radiol 2020;49:1599-610. [CrossRef]
7. Breukers M, Haase D, Konijnenberg S, Klos TVS, Dinant GJ, Ottenheijm RPG. Diagnostic accuracy of dynamic ultrasound imaging in partial and complete anterior cruciate ligament tears: a retrospective study in 247 patients. BMJ Open Sport Exerc Med 2019;5:e000605. [CrossRef]
8. Drakonaki EE, Allen GM, Wilson DJ. Ultrasound elastography for mus-

culoskeletal applications. Br J Radiol 2012;85:1435-45. [CrossRef]
9. Grzelak P, Podgórski M.T, Stefańczyk L, Domżalski M. Ultrasonographic test for complete anterior cruciate ligament injury. Indıan J Orthop 2015;49:43-149. [CrossRef]
10. Varghese T, Ophir J, Konofagou E, Kallel F, Righetti R. Tradeoffs in elastographic imaging. Ultrason Imaging 2001;23:216-48. [CrossRef]
11. Lalitha P, Reddy MC, Reddy, KJ. Musculoskeletal applications of elastography: a pictorial essay of our initial experience. Korean J Radiol 2011;12:365-75. [CrossRef]
12. Drakonaki EE, Allen GM, Wilson DJ. Real-time ultrasound elastography of the normal Achilles tendon: reproducibility and pattern description. Clin Radiol 2009;64;1196-202. [CrossRef]
13. Sahan MH, Inal M, Burulday V, Kultur T. Evaluation of tendinosis of the long head of the biceps tendon by strain and shear wave elastography. Med Ultrason. 2018;20:192-8. [CrossRef]
14. Fleming BC, Vajapeyam S, Connolly SA, Magarian EM, Murray MM. The use of magnetic resonance imaging to predict ACL graft structural properties. J Biomech 2011;44:2843-6. [CrossRef]
15. Weiler A, Peters G, Mäurer J, Unterhauser FN, Südkamp NP. Biomechanical properties and vascularity of an anterior cruciate ligament graft can be predicted by contrast-enhanced magnetic resonance imaging. A two-year study in sheep. Am J Sports Med 2001;29:751-61. [CrossRef]
16. DeFroda SF, ODonnell RM, Fadale PD, Owens BD, Fleming BC. The role of magnetic resonance imaging in evaluating postoperative ACL reconstruction healing and graft mechanical properties: a new criterion for return to play? Phys Sportsmed 2021;49:123-9. [CrossRef]
17. Lutz PM, Achtnich A, Schütte V, Woertler K, Imhoff AB, Willinger L. Anterior cruciate ligament autograft maturation on sequential postoperative MRI is not correlated with clinical outcome and anterior knee stability. Knee Surg Sports Traumatol Arthrosc 2022;30:3258-67. [CrossRef]
18. Yau WP, Chan YC. Evaluation of Graft Ligamentization by MRI After Anterior Cruciate Ligament Reconstruction. Am J Sports Med 2023;51:1466-79. [CrossRef]
19. Wang LY, Yang TH, Huang YC, Chou WY, Huang CC, Wang CJ. Evaluating posterior cruciate ligament injury by two-dimensional ultrasonography and sonoelastography. Knee Surg Sports Traumatol Arthrosc 2017;25:3108-15. [CrossRef]
20. Akkaya S, Akkaya N, Agladıoglu K, Gungor HR, Ok N, Özçakar L. Real-time elastography of patellar tendon in patients with auto-graft bone-tendon-bone anterior cruciate ligament reconstruction. Arch Orthop Trauma Surg 2016 ;136:837-42. [CrossRef]
21. Ito N, Sigurðsson HB, Pohlig RT, Cortes DH, Grävare Silbernagel K, Sprague AL. Reliability of Continuous Shear Wave Elastography in the Pathological Patellar Tendon. J Ultrasound Med 2023;42:1047-55. [CrossRef]

ORİJİNAL ÇALIŞMA - *ÖZ*

Sonoelastografi kullanılarak ön çapraz bağ rekonstrüksiyonunun klinik ve fonksiyonel sonuçlarının karşılaştırılması

AMAÇ: Ön çapraz bağ (ACL) yaralanmaları, özellikle atletik spor yaralanmaları arasında yaygındır. Çoğu klinisyen, tanı amacıyla ve tedavi değerlendirmesi için manyetik rezonans görüntüleme (MRG) kullanır; ancak maliyet ve erişilebilirlik açısından zorluklar çıkarabilir. Ultrason (USG) rehberliği daha erişilebilir olsa da, ACL yaralanmasını tek başına teşhis etmek için yetersizdir. Bu nedenle, çalışmamız, tendon problemlerini incelemek için yeni bir yöntem olan sonoelastografinin, ön çapraz bağ yaralanmaları üzerindeki etkinliğini test etmeyi amaçladı.

GEREÇ VE YÖNTEM: Bu çalışma, belirlenen dahil etme kriterlerini karşılayan 45 hastadan oluşan bir kohortu kapsadı. Hastaları, 2017 ile 2020 yılları arasında ortopedi ve travmatoloji kliniğinde anatomik ACL onarımı geçiren 105 bireyden oluşan bir kohorttan seçtik. Klinik muayene sonuçları ve ACL rekonstrüksiyonu yapılan hastalarda ACL'nin stabilitesi ve kalitesi, manyetik rezonans görüntüleme (MRG) ve stres eko gevşekliği (SEL) test sonuçlarıyla karşılaştırıldı.

BULGULAR: Çalışma, ortalama yaşı 30.7±1.4 yıl olan 40 bireyden oluşuyordu. Hastaların Lysholm puanları, ameliyat sonrası önemli bir iyileşme gösterdi ve ortalama olarak ameliyat öncesi 2.2±0.9'dan ameliyat sonrası 6.1±1.6'ya yükseldi. Lachman, anterior drawer ve pivot-shift testleri, preoperatif değerlere göre iyileşmeler gösterdi. Tek bacak zıplama testinde, etkilenmeyen tarafa göre önemli bir fark gözlemlenmedi. SEL bulguları, sağlıklı ACL örneklerinin %15,6'sının tip 2a, %68.9'unun tip 2b ve %15.6'sının tip 3a olarak kategorize edildiğini gösterdi. Rekonstrükte ACL kohortunda, %17.8'i tip 2a, %62.2'si tip 2b ve %20'si tip 3a olarak kategorize edildi. Sağlıklı ACL ile rekonstrükte ACL arasında önemli bir istatistiksel fark tespit edilmedi. Hiçbir hastada tip 3b veya tip 4 vakası tespit edilmedi.

SONUÇ: Yırtılmış bir ACL tespit etmek ve bağ rekonstrüksiyonu yapıldıktan sonra stabilitesini ve durumunu kontrol etmek için SEL kullandık. SEL veya stres sonoelastografi kullanarak greftin canlılığını izliyoruz ve ACL yaralanmalarının ilerlemesini değerlendiriyoruz. Ayrıca, onarılan bağın normal bir bağa benzer işlevsel bir yapıya sahip olup olmadığını değerlendirmede de faydalıdır. Bunların yanında, erişilebilirliği, maliyet etkinliği, tekrarlanabilirliği ve hasta tercihini göz önünde bulundurulduğunda, MRG'ye göre daha avantajlı bir alternatif sunabilir.

Anahtar sözcükler: ÖÇB rüptürü; ÖÇB rekonstrüksiyonu; sonoelastografi; ultrason.

Ulus Travma Acil Cerrahi Derg 2025;31(11):1088-1094 DOI: 10.14744/tjtes.2025.73730