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Original Article

Real-Time Sonoelastography Evaluation of the Lateral Collateral Ligament of Ankle: Comparative Findings Between Athletes and Healthy Subjects

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ABSTRACT

Objective: The aim of this study is to assess the sonography and elastography findings in the lateral collateral ligament (LCL) injury due to recurrent ankle sprains and to compare them to those of healthy individuals.

Methods: A total of 108 ankles in 54 athletes and 60 ankles in 30 healthy volunteers were included. The LCL, consisting of the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL) and the posterior talofibular ligament (PTFL), was evaluated for images in the following three sections: proximal, middle and distal. Longitudinal images of each tendon were obtained using ultrasound (US) and real-time sonoelastography. Degeneration of each tendon was evaluated in four grades and the length and thickness were measured in sonographic images. Real-time sonoelastography images were evaluated in four grades for elasticity pattern and strain ratios.

Results: The length of ATFL was shorter in the patient group than in the control group (p=0.028). There was no difference between the patient and control group for ligament thicknes. Sonographic grades in the patient group were statistically increased compared to thecontrol group for ATFL, CFL and PTFL ligaments (p<0.001).

Conclusion: US can be used as a non-invasive diagnostic method to demonstrate ankle LCL injuries in athletes. Real-time sonoelastography provides useful additional information for the evaluation of patients with chronic sprains of the ankle LCL.

INTRODUCTION

Ankle sprain is the most common musculoskeletal injury during sports activity. As a result of these sprains, the lateral collateral ligament (LCL) complex consisting of the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), and the posterior talofibular ligament (PTFL), is often damaged.[1,2] Recurrent ankle sprain increase damage in this ligament, thus lead to chronic ankle instability.[3,4] Arthroscopy and intraoperative findings are the gold standard methods in identifying LCL injuries.[5] However, these procedures are not preferred practically, as they are invasive and difficult techniques. Radiographs may show the soft tissue swelling in the ankle, however, further investigation may be needed for the diagnosis of the ligament injuries.[6] The ligament can be evaluated with magnetic resonance imaging (MRI), with high sensitivity and specificity. On the other hand, its use is limited because it is an expensive technique and not easily accessible.[5,6] Ultrasound (US) is a cost-effective and reliable diagnostic method allowing for real-time examination. It is an effective diagnostic method for the evaluation of the injury in ligaments.[7–11] The ultrasound elastography (USE) allows us to measure the flexion response of the tissue related to stiffness properties and periodic pressure effect. Therefore, the pathology in the tissue can be shown by qualitative or quantitative data such as color scale or the strain ratio (SR) respectively.[12,13] There are several studies showing the efficacy of USE in the pathologies such as tendinopathy, lateral epicondylitis, or plantar fasciitis.[14–19] Based on the above data, we aimed to reveal the findings of USE in LCL injury due to recurrent ankle sprains and compare them to those of healthy individuals.

MATERIALS AND METHODS

A total of 54 adult patients between the ages of 18-40 and engaged in sports activities, who was admitted to our hospital's sport medicine outpatient clinic, were included to study. The patient group had a history of recurrent episodes of ankle sprain during sports activities. The control group was selected from patients without ankle complaints admitted to our radiology department for different ultrasonographic examinations. The control group consisted of 30 healthy subjects who did not have any sports activities. The control subjects also did have complete questionnaires regarding ankle sprains. Presence of congenital or rheumatologic disease of the musculoskeletal system and history of ankle surgery, smokers and alcohol consumers were excluded from the study. All patients and control subjects were examined using the special instability tests for the evaluation of the ankle by an experienced sports medicine specialist. Ligament elasticity was evaluated and the grading for the ankles was recorded by the sports clinic. In Grade 1, ligament laxity was normal. Grade 2 had increasing ligament laxity, but there was a sense of endpoint. Endpoint sense could not be obtained in the Grade 3. The control group consisted of subjects with Grade 1 laxity. The patient group consisted of athletes with Grade one, two or three ligamental laxity. Body weights and heights of individuals in both groups were recorded. The Body Mass Index(BMI) was calculated. Sonographic examination of the ankle was performed with a Toshiba Aplio 500 device (Toshiba Medical Systems Corporation, Tokyo, Japan) using a 12 MHz linear transducer. All US and USE examinations were performed by a radiologist blinded to the patient and control groups. First, B mode US examination of the ligaments was performed in the sitting position of the patient on the stretcher. The ankle was brought to a 45 degree plantar and medial flexion. The probe was placed parallel to the fibers of the ATFL ligament, in a slightly inferior oblique position, in contact with the anterior part of the distal edge of the lateral malleolus. For CFL, the foot was gently brought into dorsiflexion. The probe was placed on the posterolateral corner of the lateral malleol distal edge in the oblique coronal plane. Then, the CFL was imaged extending from the calcaneus to the fibula under the peroneus longus and brevis tendons (Fig. 1). For the PTFL, the plantar surface of the foot was brought into contact with the stretcher. The probe was then placed on the posterior corner of the lateral malleol distal edge in the transverse plane. We attempted to visualize the PTFL, deeply under the peroneus longus and brevis tendons, extending obliquely from the posterolateral edge to the medial side. The lengths of

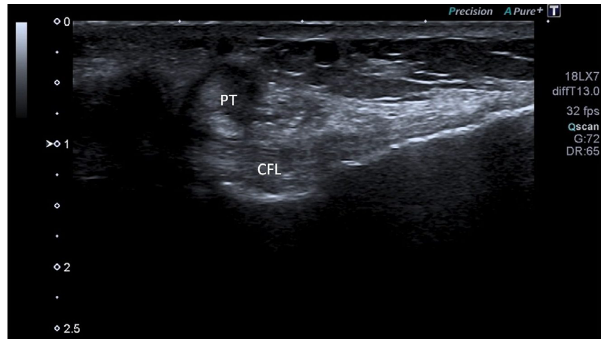

Figure 1. Longitudinal B-mode ultrasound scan shows the CFL under peroneal tendons (PT).

each ligament were measured in the longitudinal plane. The thickness of the ligaments was measured in three regions as proximal, middle and distal. The mean thickness of the ligament was calculated by taking the arithmetic mean of the thickness values obtained from three regions. In this study, B-mode US grading was performed by modifying the grading system proposed for ankle LCL by Yi Cheng et al.[9] The ligament with a fully smooth contour and a fully hyperechoic fibrillar structure was defined as Grade 0. The ligament with an irregular contour and local hypoechogenicity anywhere was defined as Grade 1. The ligament with an irregular contour and heterogeneity and/or partial tear was defined as Grade 2. A full-thickness tear in the ligament was defined as Grade 3. USE examination was performed using real-time strain elastography technique. Movement of touch with the probe (compression) and its retraction (decompression) were displayed on the US monitor as two separate windows which were B-mode and color elastogram. The elastography window was adjusted to accommodate the respective ligament and subcutaneous fatty tissue taken as reference. Compression-decompression was applied to the examined region and followed graphically from the lower region of the monitor. The most favorable decompression phase was selected from the wave spectrum. A region of interest (ROI) sized to represent the area to be imaged and the ROI referencing the subcutaneous fat tissue adjacent to this area was placed, and the measurements were recorded as strain ratio (SR). The SR values were obtained from the proximal, middle, and distal sections of each ligament, and the arithmetic means of the SR values measured from the three regions of the ligament were recorded as the mean SR value. A color scale, called an elastogram, coded from red to blue to indicate the stiffness degree of the ligaments was used. The ligament structures were coded from blue to red according to their stiffness grades. The stiff, the soft, and the medium-hard stiff tissues were seen as blue, red and green, respectively. Proximal, middle, and distal sections of the elastogram findings of each ligament were classified into four types. If the examined region was only blue, blue-weighted green or green-weighted, only green with the presence of yellow-red areas, it was classified as Type 1, Type 2, Type 3, Type 4 respectively (Figs. 2–6).

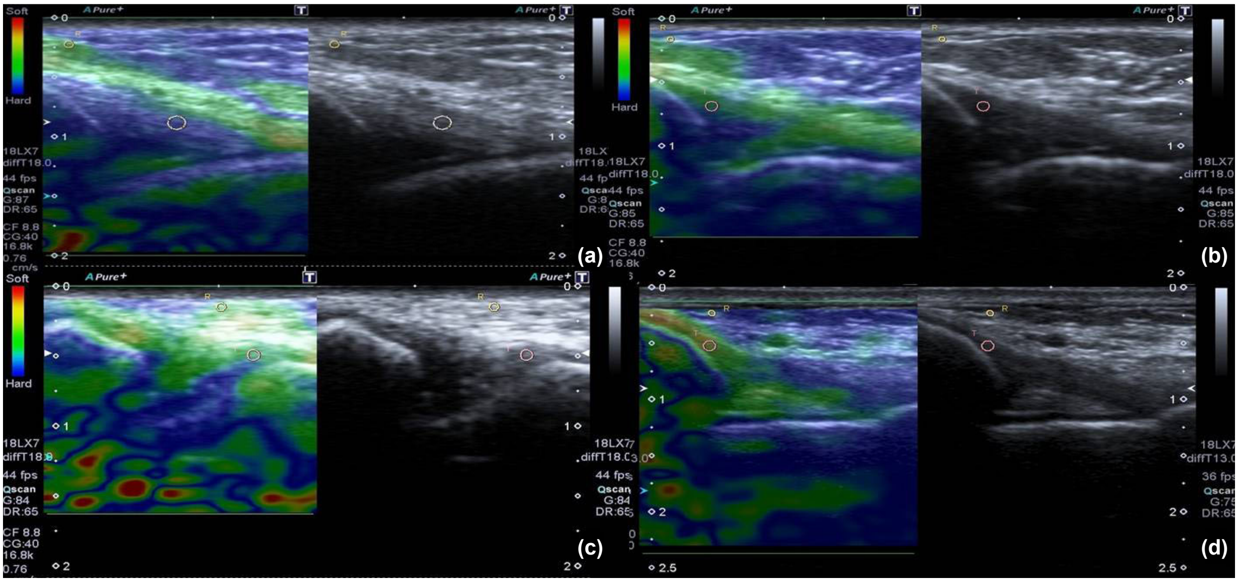

Figure 2. An ATFL is shown according to elastogram types in the longitudinal plane; **(a)** stiff pattern (blue) normally, Type 1; **(b)** green weighted blue, Type 2; **(c)** only green, Type 3; **(d)** red area in the proximal part of ATFL, Type 4.

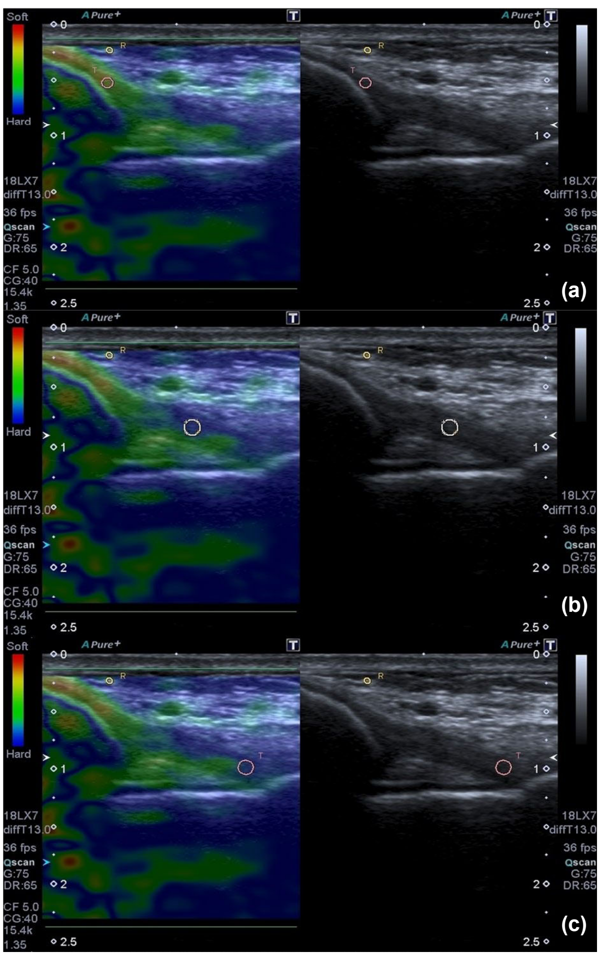

Figure 3. A 25-year-old patient with normal ATFL on the B-mode US and abnormal color signs with elastography. Longitudinal real-time sonoelastographic and B-mode ultrasound **(a-c)** scans showing the proximal, middle and distal part of the ATFL. **(a)** The proximal part of the ATFL; red-green color pattern; **(b)** Middle part of the ATFL; blue-green color pattern; **(c)** Distal part of the ATFL, blue-green color pattern.

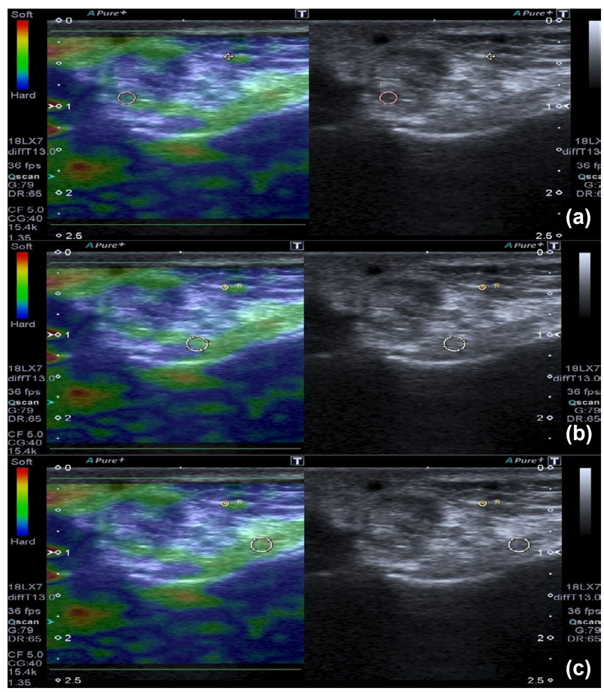

Figure 4. CFL with focal hypoechoic areas on B-mode ultrasonography shows abnormal color signs in elastography. **(a)** Proximal part of the ATFL, blue-green color pattern; **(b)** Middle part of the ATFL, blue-green color pattern. **(c)** Distal part of the ATFL, green color pattern.

Statistical analysis

Statistical analysis was performed using the SPSS version 20.0 software (IBM Corp., Armonk, NY, USA). Thw normal distribution fit test was assessed with the Kolmogorov Smirnov test. Numerical variables were expressed as mean ± standard deviation (SD), and median (25th percentile - 75th percentile), and frequency (percentile). Differences between the groups were assessed using the Mann-Whit-

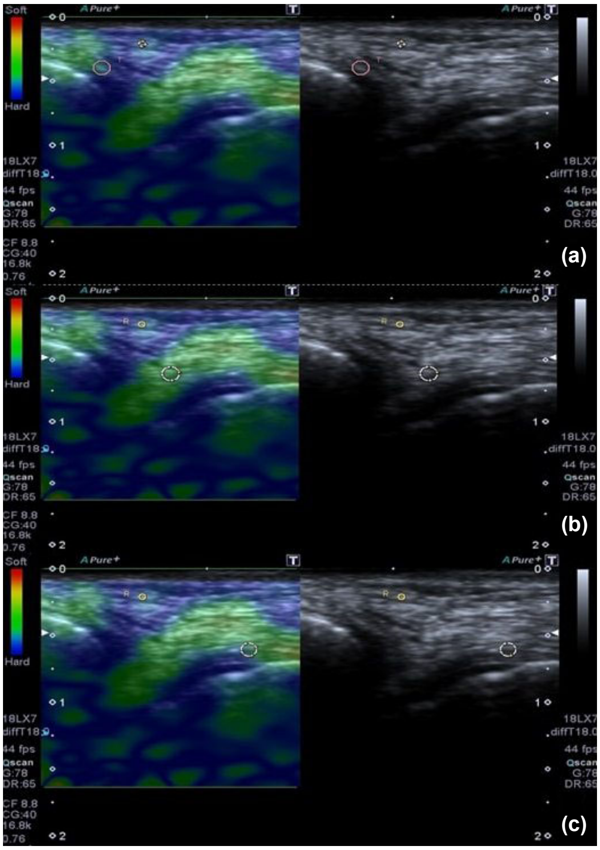

Figure 5. Longitudinal real-time sonoelastographic and B-mode ultrasound scans show full- thickness rupture in the middle part of the ATFL. **(a)** Proximal part of the ATFL; blue-green color pattern; **(b)** Middle part of the ATFL, full-thickness rupture on the B-Mode US, green color pattern; **(c)** Distal part of the ATFL, blue-green color pattern.

ney U test for numerical variables that did not show normal distribution. The Fisher's exact chi-square, Yates chi-square, and Monte Carlo chi-square tests were used to analyze categorical variables.

RESULTS

The mean age of the athletes (39 males, 15 females) was 26.9±5.0 (mean±SD) years and for the control group(19 males, 11 females) was 27.7±4.9 (mean±SD) years. A total of 168 ankles, 108 ankles of 54 patients and 60 ankles of 30 controls, were examined. The demographic data of all

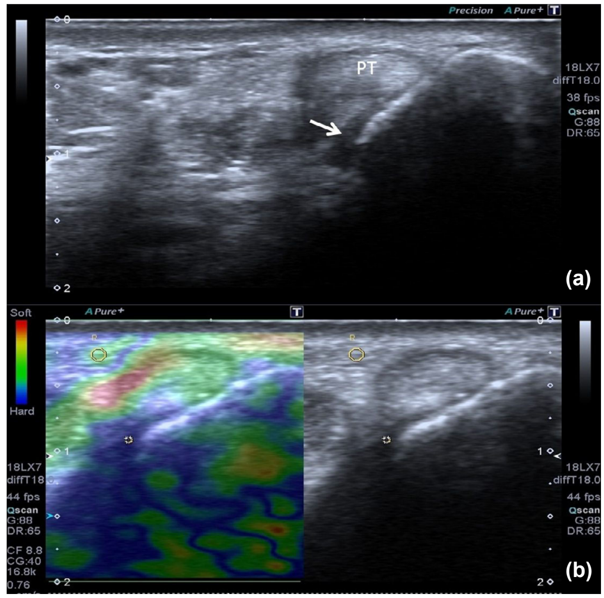

Figure 6. **(a)** B-mod US shows the proximal part of the PTFL (white arrow). PT: Peroneal tendons. **(b)** Real-time sonoelastographic and B-mode ultrasound scans proximal part of the PTFL, blue color pattern (type 1 elastogram).

participants are shown in Table 1.

In the patient group, eight ankles (7.4%) were symptomatic, and one hundred ankles (92.6%) were asymptomatic. There were no symptomatic subjects in the control group. Minimal fluid was detected near the ATFL by ultrasonographic examination in twelve patients (11.1%) in the patient group. In the patient group, only five patients had a full-thickness tear for ATFL of the unilateral ankle on B-mode ultrasonographic examination (Fig. 5).

The ATFL lengths were shorter in the patient group than in the control group (p<0.05). However, there was no statistically significant difference between CFL and PTFL lengths in both groups (p>0.05). The thicknesses of the proximal, middle, distal regions and the mean thicknesses of the ligaments were not different between the two groups. The length and thickness measurements of the ligaments in the two groups were shown in Table 2.

The ATFL, CFL, and PTFL ultrasonographic grades were found to be increased in the patient group compared to the control group (p<0.001, p<0.001, p<0.05, respectively). The elastogram pattern in the proximal, middle and

Table 1. Age, body weight, height and BMI values of patient and control group

	Patient (n=54)		Control (n=30)		p-value
	Mean±SD	Median (25–75 percentil)	Mean±SD	Median (25–75 percentil)	
Age	26.9±5.0	26.5 (23–30)	27.7±4.9	27 (25–30)	0.399
Body weight (kg)	69.8±12.6	70 (60–78)	71.6±14.7	70 (61–83)	0.478
Height (cm)	173.5±10.5	173 (167–185)	172.1±9.6	170 (166–180)	0.434
BMI (kg/m^2)	23.1±3.01	22.7 (21–24.6)	24.0±3.5	23.6 (21.7–26.3)	0.030*

*P<0.05: Statistically significant difference. BMI: Body mass index; SD: Standard deviation.

Table 2. Comparison of thicknesses, lengths and grades of proximal, middle and distal segments of ATFL, CFL, PTFL for the patient and control group

	Patient (n=108)		Control (n=60)		p-value
	Mean±SD	Median (25–75 percentil)	Mean±SD	Median (25–75 percentil)	
ATFL					
Length	20.69±3.69	20.50 (18.00–23.30)	22.05±3.30	21.9 (19.53–24.98)	0.028*
Proximal thickness	2.20±0.57	2.20 (1.80–2.60)	2.27±0.39	2.30 (2.00–2.50)	0.343
Middle thickness	2.26±0.54	2.20 (1.90–2.58)	2.30±0.42	2.30 (2.10–2.60)	0.382
Distal thickness	2.23±0.54	2.20 (1.90–2.50)	2.31±0.41	2.20 (2.10–2.50)	0.333
Mean thickness	2.23±0.52	2.20 (1.88–2.53)	2.29±0.39	2.27 (2.03–2.56)	0.332
Grade	1.49±0.79	1.00 (1.00–2.00)	0.00±0.00	0.00 (0.00–0.00)	0.00*
CFL					
Length	26.71±4.16	26.35 (24.40–29.48)	27.39±3.75	27.20 (24.93–30.18)	0.267
Proximal thickness	2.45±0.39	2.40 (2.20–2.70)	2.37±0.38	2.30 (2.10–2.60)	0.163
Middle thickness	2.45±0.41	2.40 (2.13–2.70)	2.36±0.41	2.30 (2.20–2.60)	0.193
Distal thickness	2.44±0.39	2.40 (2.20–2.70)	2.36±0.37	2.30 (2.10–2.50)	0.119
Mean thickness	2.45±0.37	2.43 (2.17–2.69)	2.36±0.36	2.32 (2.18– 2.49)	0.112
Grade	0.00±0.80	0.00 (0.00–1.00)	0.07±0.25	0.00 (0.00–0.00)	0.00*
PTFL					
Length	4.84±1.37	4.55 (3.70–5.63)	4.61±1.29	4.45 (3.60–5.60)	0.415
Proximal thickness	0.89±0.26	0.90 (0.70–1.00)	0.97±0.83	0.90 (0.70–1.00)	0.745
Middle thickness	0.95±0.26	0.90 (0.80–1.20)	0.91±0.22	0.90 (0.73–1.10)	0.663
Distal thickness	0.99±0.31	0.90 (0.80–1.20)	1.06±1.06	1.00 (0.80–1.08)	0.504
Mean thickness	0.94±0.24	0.93 (0.77–1.10)	0.98±0.46	0.93 (0.81–1.06)	0.726
Grade	0.46±0.52	0.00 (0.00–1.00)	0.27±0.45	.00 (.00–1.00)	0.017*

*P<0.05: Statistically significant difference. BMI: Body mass index; ATFL: Anterior talofibular ligament; CFL: Calcaneofibular ligament; PTFL: Posterior talofibular ligament; SD: Standard deviation.

distal parts of the ATFL and CFL were softer than the control group (p<0.001). The elastogram types of PTFL were not different between the two groups. The elastogram types in the proximal, middle and distal sections of ATFL, CFL, and PTFL were shown in Table 3. In the patient group, the SR value in all three regions and the mean SR values for ATFL and CFL were found to be significantly lower than the control group (p<0.001). The SR of PTFL was not different between the two groups. The mean, median, and p values of the SR of ATFL, CFL, and PTFL were shown in Table 4 for both groups.

We also compared the dominant foot of the patient group with the non-dominant foot, and we found no significant difference between the two groups in terms of parameters of US, elastogram types, and SR values.

DISCUSSION

Early diagnosis of LCL injury is important. Early degenerative alterations due to the ankle instability in the joint can be treated using conservative techniques without an invasive surgical procedure.[20,21] US is an effective diagnostic method with high sensitivity and specificity in the lateral ankle injury and chronic ankle instability. The sensitivity and specificity of US in ATFL injuries were found to be 97.7% and 92.3%, respectively, in an arthroscopic study.[22] Gun et al.[23] has also shown that the sensitivity and specificity of US in ATFL injuries were 93.8% and 100% compared to MRI. In the present study, we assessed the LCL in athletes with recurrent ankle inversion injuries during sports activities using B-Mod US and USE. We found a statistically significant increase in degeneration findings in all three ligaments in the athlete group according to sonographic imaging. We also detected a softer elastogram pattern and lower SR values for all three ligaments of the athlete group compared to the control group, consistent with the sonographic findings. This difference was statistically significant in ATFL and CFL.

In recent studies, USE has been used to evaluate the stiffness of the various musculoskeletal tissues.[14–19] Collagen fibrils are damaged secondary to mucoid degeneration or minor interstitial tears. Due to destruction, the elasticity of the fibers changes, and the tendons become softer. These softer tendon structures can be detected with elastography before they become apparent on the B-mode US. However, the tendon regions repaired by fibrosis resulted in the increase of tissue stiffness with a harder elasticity pattern.[24–26] It has been shown that degeneration regions within the symptomatic Achilles tendons represent hypoechogenic areas on the B-mode US and softer areas in strain USE images.[15] De Zordo et al.[17] has used strain USE around the elbow to assess the common extensor

Table 3. The numbers and percentage of the distributions of the elastogram types of proximal, middle and distal segment of ATFL, CFL, PTFL in the patient and control group

	Elastogram types	Patient ankle (n=108%)	Control ankle (n=60%)
ATFL			
Proximal	Type 1	23 (21.3%)	58 (96.7%)
	Type 2	44 (40.7%)	2 (3.3%)
	Type 3	38 (35.2%)	0
	Type 4	3 (2.8%)	0
Middle	Type 1	23 (21.3%)	54 (90%%)
	Type 2	57 (52.8%%)	6 (10%%)
	Type 3	27 (25.0%)	0
	Type 4	1 (0.9%)	0
Distal	Type 1	17 (15.7%)	57 (95%)
	Type 2	66 (61.1%)	3 (5%)
	Type 3	24 (22.2%)	0
	Type 4	1 (0.9%)	0
CFL			
Proximal	Type 1	72 (66.7%)	60 (100%)
	Type 2	29 (26.9%)	0
	Type 3	6 (5.6%)	0
	Type 4	1 (0.9%)	0
Middle	Type 1	74 (68.6%)	59 (98.3%)
	Type 2	28 (25.9%)	1 (1.7%)
	Type 3	5 (4.6%)	0
	Type 4	1 (0.9%)	0
Distal	Type 1	71 (65.7%)	55 (91.7%)
	Type 2	28 (25.9%)	5 (8.3%)
	Type 3	7 (6.5%)	0
	Type 4	2 (1.9%)	0
PTFL			
Proximal	Type 1	70 (66%)	41 (68.3%)
	Type 2	17 (16%)	9 (15%)
	Type 3	18 (17%)	10 (16.7%)
	Type 4	1 (0.9%)	0
Middle	Type 1	77 (72.6%)	45 (75%)
	Type 2	18 (17%)	10 (16.7%)
	Type 3	10 (9.4%)	5 (8.3%)
	Type 4	1 (0.9%)	0
Distal	Type 1	79 (74.5%)	50 (83.3%)
	Type 2	15 (14.2%)	4 (6.7%)
	Type 3	11 (10.4%)	6 (10%)
	Type 4	1 (0.9%)	0

ATFL: Anterior talofibular ligament; CFL: Calcaneofibular ligament; PTFL: Posterior talofibular ligament.

Table 4. Comparison of ATFL, CFL and PTFL strain ratio (SR) values in the patient and control group

Strain Ratio	Patient (n=108)		Control (n=30)		p-value
	Mean±SD	Median (25–75 percentil)	Mean±SD	Median (25–75 percentil)	
ATFL					
Proximal	1.92±1.80	1.22 (0.89–2.30)	5.20±1.86	5.00 (3.62–6.58)	0.000*
Middle	1.89±1.53	1.50 (0.93–2.25)	5.39±2.20	4.87 (3.55–6.69)	0.000*
Distal	1.85±1.50	1.36 (1.02–2.24)	5.62±2.15	5.18 (3.79–7.49)	0.000*
Mean	1.89±1.37	1.48 (1.02–2.16)	5.40±1.54	5.46 (4.27–6.55)	0.000*
CFL					
Proximal	4.69±2.90	4.15 (2.20–6.67)	7.39±2.93	6.90 (4.97–9.30)	0.000*
Middle	4.98±2.90	4.80 (2.27–7.18)	7.34±2.57	7.32 (5.33–8.61)	0.000*
Distal	5.1±3.20	5.09 (1.99–7.41)	7.08±2.97	7.21 (4.60–9.41)	0.000*
Mean	4.9±2.47	5.25 (2.92–6.85)	7.27±2.23	7.39 (5.68–8.48)	0.000*
PTFL					
Proximal	4.59±3.24	4.34 (1.36–7.17)	4.73±3.43	3.81 (1.93–6.83)	0.84
Middle	5.01±3.63	4.02 (2.03–7.32)	5.65±3.93	4.80 (2.32–8.45)	0.325
Distal	5.81±4.52	4.64 (2.51– 8.28)	5.93±3.64	5.16 (3.55–8.32)	0.439
Mean	5.14±3.07	4.89 (2.50–7.10)	5.44±2.99	5.52 (3.15–7.45)	0.505

*P<0.001: Statistically significant difference. ATFL: Anterior talofibular ligament; CFL: Calcaneofibular ligament; PTFL: Posterior talofibular ligament; SD: Standard deviation.

tendon. In their study, the symptomatic common extensor tendons were shown to be softer compared to the healthy volunteers. Sconfienza et al.[27] have found that the plantar fascia is thicker and more hypoechoic in symptomatic patients compared to control subjects in a study using strain USE. Researchers have suggested that it has correlated with a loss of elasticity or a harder fascia. There are few studies on the elastography of ligaments. Wu et.

all have reported that the coracohumeral ligament has increased in thickness and stiffness in patients with adhesive capsulitis compared with their unaffected contralateral shoulder.[28] The authors suggested that the stiffening of the ligament in patients with adhesive capsulitis can be related with limitation of motion during external rotation of the glenohumeral joint. In a recent prospective study, researchers have investigated the feasibility of shear wave velocities for ATFL using acoustic radiation force impulse elastography in healthy athletes.[29] They have suggested that sonoelastographic values could provide a functional marker that aids in the evaluation during injury, healing and maturation of ATFL. They have also emphasized that acoustic radiation force impulse elastography in ATFL has a high inter-rater and intra-rater reliability, 0.902 and 0.933, respectively.[29]

The LCL ligaments formed by hyperechoic fibrils are observed with fully straight contoured in the normal longitudinal US imaging. The histological structure of the normal ligament is composed of type I collagen with mild fluctuating course, extracellular matrix, and fibroblast cells. Repetitive inversion movements cause stretching in LCL during sports activities, micro-tears can occur in the ligaments. While these injuries are healing with the immature connective tissue structures, the ligaments lose their previous strain.

Increased sonographic grading and decreased elastographic SR values of the ATFL and CFL ligaments in this study have shown us that the recurrent sprains have developed pathological alterations in the structure of these ligaments. However, although the values of sonographic grades have increased in PTFL, both elastogram and SR values have not shown any statistical difference between the athletes and control groups. This may support the fact that the ligament which is the least affected by trauma in all LCL structures is PTFL. Furthermore, as a result of recurrent sprains, thickening of the ankle ligament, abnormal length values, focal defects or bone fragments in the ligament can be seen in the B-Mod US.[9] In the study conducted by Liu et al.,[30] the authors compared the thickness of ATFL between one control and two patient groups and found that ligament thickness increased in the patient group. However, in the present study, we found no significant difference in ATFL, CFL and PTFL thickness between the two groups. Nonetheless, when compared with the lengths of the ligaments, only the length of ATFL in the patient group was shorter than in the control group. We think that the patients who were evaluated as full-thickness rupture on the B-Mod US imaging in the patient group caused the findings of the difference in length values between the two groups in our study.

On the other hand, this study has several limitations. First, a semi-quantitative method was used in the USE examination. There was no scale to measure the amount of compression-decompression. Therefore, the pressure application level of compression and decompression was practitioner-dependent. Second, as the patient group includes active individuals who play active sports and have a recurrent ankle sprain, symptoms will not be generalized to other individuals of different age groups in the sedentary lifestyles population with recurrent ankle sprains. Third, we experienced difficulties in elastographic evaluation of PTFL due to its lesser area than that of the probe, its oblique anatomical orientation, and the protrusion of the distal end of the lateral malleol located in the posterolateral margin.

In conclusion, LCL damage caused by chronic recurrent ankle sprains in athletes can be shown using sonography even if they are not complaining. The USE examination can demonstrate strain alterations in the ligament structures. Therefore, USE can support the sonographic and clinical examination findings in ankle LCL injuries.

Ethics Committee Approval

This study approved by the Kocaeli University Faculty of Medicine Non-Invasive Clinical Research Ethics Committee (Date: 05.10.2016, Decision No: 2016/16.7).

Informed Consent

Prospective study.

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: A.K.B., T.Ö.; Design: T.Ö., N.V.; Supervision: A.K.B., N.V.; Fundings: B.F., A.K.B.; Materials: B.F., A.K.B.; Data: A.K.B., T.Ö.; Analysis: N.V., T.Ö.; Literature search: A.K.B.; Writing: A.K.B., T.Ö.; Critical revision: B.F., T.Ö.

Conflict of Interest

None declared.

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Lateral Kollateral Ligamanın Ultrason Elastografi İle Değerlendirilmesi: Sporcular ve Sağlıklı Bireylerin Bulgularının Karşılaştırılması

Amaç: Çalışmanın amacı tekrarlayan ayak bileği burkulmalarında lateral kollateral ligaman (LKL) hasarını ultrason (US) ve ultrason elastografi (USE) ile değerlendirerek, bulguları sağlıklı bireylerle karşılaştırmaktır.

Gereç ve Yöntem: Sporla uğraşan 54 kişi (toplamda 108 ayak bileği), sağlıklı 30 kişi (toplamda 60 ayak bileği) çalışmaya dahil edildi. LKL'yi oluşturan anterior talofibular ligaman (ATFL), kalkaneofibular ligaman (KFL) ve posterior talofibular ligamanların (PTFL) proksimal, orta ve distal parçaları değerlendirildi. Ligamanların US ve USE değerlendirilmesi longitudinal planda yapıldı. Ligamanların uzunluğu ve kalınlığı ölçüldü; hasarlanması dört derecede değerlendirildi. USE paternleri de dört derecede değerlendirildi ve gerinim oranları hesaplandı.

Bulgular: ATFL uzunluğu hasta grubunda kontrol grubundan daha kısaydı ($p=0.028$). Ligamanların kalınlığında her iki grup arasında farklılık saptanmadı. ATFL, KFL ve PTFL'nin ultrasondaki hasarlanma dereceleri hasta grubunda daha yüksek tespit edidi ($p<0.001$).

Sonuç: Sporcularda ayak bileği LKL hasarının gösterilmesinde US non-invaziv tanı yöntemi olarak kullanılabilir. USE kronik LKL yaralanmalarının değerlendirimesin US' ye tanısal katkı sağlar.

Anahtar Sözcükler: Ayak bileği; lateral kollateral ligaman; ultrason; ultrason elastografi.