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Evaluation of Distal Tibiofibular Syndesmosis Morphology in Ankle Sprains

Evaluación de la Morfología de la Sindesmosis Tibiofibular Distal en Esguinces de Tobillo

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SUMMARY: It is suggested that there is a connection between the ankle and distal tibiofibular syndesmosis (DTS) and the possible differences in DTS morphology may be a reason of an instability. This study is aimed to assess the DTS morphology in patients with ankle sprains as radiologic and anatomic. In the study, MR images of 66 patients diagnosed with ankle sprain were compared with 66 healthy control group. Anterior facet length (AFL), posterior facet length (PFL), angle between anterior-posterior facet (APFA), incisura fibularis depth (IFD), tibia length (LT) and fibula length (LF) were measured from 1cm above the tibial plafond. In addition, DTS morphology was classified as chevron, widow's peak, flat, trapezoid, and crescent and it was examined whether it affected ankle sprain. Additionally, posterior tibiofibular ligament width (PTFLW) was examined. The mean age for the patientgroup (n= 66; 38 females and 28 males) was 36.55±10.82years, while the mean age for the control group (n=66; 41 females and 25 males) was 40.83±10.48years. In the control group, the means of the AFL, PFL, APFA, IFD, LT, LF, and PTFLW were found as 10.9±2.4 mm, 10.2±1.8 mm, 140.26±12.33 degree, 3.2±1.2 mm, 37.4±4.4 mm, 10.7±1.8 mm, and 5.4±1.0 mm, respectively while the same measurements were measured as 11.1±2.0 mm, 10.6±2.3 mm, 141.39±11.01degree, 3.2±1.1 mm, 38.5±3.6 mm, 11.1±2.0 mm and 5.4±1.0 mm in subjects having ankle sprains, respectively. The distribution of incisura fibularis morphology was observed to be mostly crescent type with 38 % in the patient group, followed by flat type with 19 %. In the control group, the most common type was flat type with 27 %, followed by crescent type with 24 %. This paper found that DTS morphology might be a risk factor for ankle sprains. Also, incisura morphology showed between healthy subjects and patients with ankle sprains. While crescent type is more common in normal individuals, shallow type is more common in patients with ankle sprains.

KEY WORDS: Ankle sprains; Distal tibiofibular syndesmosis; Morphology.

INTRODUCTION

Ankle sprains are common injuries and are usually seen in sports injuries, but there is a possibility of sprains during daily activities and even when getting out of bed. The most common mechanism is damage to the lateral ligament complex with inversion ankle sprains. One in 10.000 people suffers an ankle sprain every day. Biomechanically, the ankle joint and the distal tibiofibular syndesmosis (DTS) joint are interconnected (Waterman *et al*., 2010; Liu *et al*., 2017). A stable syndesmosis is very important for normal ankle function. Syndesmosis injuries can occur due to ligament complex injuries or bone ruptures and constitute 10-13 % of all ankle sprains. Expanding the ankle mortise by 1-2 mm reduces the contact area in the tibiotalar joint by 42 % (Harris & Fallat, 2004; Ataoglu *et al*., 2023).

The connection between the distal tibia and the fibula that forms a mortise for the talus trochlea is called a syndesmosis (Liu *et al*., 2022). The DTS joint includes the anterior inferior tibiofibular ligament (ATFL), posterior inferior tibiofibular ligament (PTFL), transverse tibiofibular, and interosseous ligaments. The complex bony and ligamentous anatomy of the syndesmosis provides stability to the ankle mortise by anchoring the distal fibula to the fibular incisura of the tibia. The morphology of the syndesmosis joint generally consists of a convex fibula and a concave fibular incisura of the tibia (Liu *et al*., 2018, 2022). The size and shape of the tibial incisor plays an important role in ankle injury. While the ATFL is usually damaged first in ankle sprains, as the severity of the sprain increases, the PTFL and other syndesmotic structures are also damaged.

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In patients with suspected distal tibiotalar joint instability, a Computed Tomography (CT) scan or Magnetic Resonance Imaging (MRI) should be performed to more accurately evaluate the position of the fibula within the incisura tibialis (Oae *et al*., 2003; Hermans *et al*., 2010; Ataoglu *et al*., 2023).

Studies show that DTS morphology affects the ankle. However, studies on this subject are limited and not detailed (Hermans *et al*., 2010). Our aim in this study is to reveal the effect of DTS morphology on ankle sprains. We believe that this study will help orthopedists, surgeons and clinicians by providing information about DTS morphometry and its relationship with ankle sprains.

MATERIAL AND METHOD

Participants. This retrospective study was conducted with MRI images of 66 (38 female and 28 male) patients with ankle sprains and 66 (41 female and 25 male) healthy individuals for the control group who applied to Adana Dr. Turgut Noyan Application and Research Center between 2019-2024. This study was approved by the Baskent University Institutional Review Board and Ethics Committee (Project no: KA24/280) and supported by Baskent University Research Fund. The inclusion criterion for the patient group was patients who applied with ankle sprain complaints and were detected to have ATFL tears, while the exclusion criteria for the same group were systemic disease that could affect the ankle, joint degenerative disease such as osteoarthritis, deformity, fracture or fracture that could affect the relevant region, previous surgery in the relevant region, and recurrent ankle sprain complaints. The inclusion criteria for the control group were determined as not having joint degenerative systemic disease and deformity that could affect the ankle and especially the DTS, not having a history of surgery, and not having a history of ankle sprain. Artifactual images and unclear images were excluded. In the power analysis; a total sample of 132 people was determined as n1=66 and n2=66, which would provide 80 % test power at a 95 % confidence level with an effect width of d=0.6324555* for the "Student t-test". In order to minimize the effect of age on joint morphology, older and younger subjects were not included in the study (Mosher *et al*., 2000).

Measurements. Image analyses were performed randomly by two observers [observer 1; expert radiologist (ZA), observer 2; anatomist (MT)]. Two observers reviewed the MR images and performed the measurements in consensus. For intraobserver variability, all measurements were performed randomly by consensus in different sessions at least 2 weeks apart from the initial assessments to minimize recall bias. The average of the two measurements was used for the final values of all measured measurements. All measurements were made using digital calipers on MR images. All MRI images were performed on a 3-Tesla Siemens Skyra MRI Scanner (Erlangen, Germany). All MRI studies were performed using a dedicated foot and ankle coil with the following sequences and parameters: (1) Sagittal fat-saturated T2-weighted; TR:4530 ms, TE 72ms, ET 15 ms, slice thickness 3 mm, FOV 25 × 18,8 cm (2) Sagittal T1 weighted; TR:680 ms, TE 11 ms, ET 3 ms, slice thickness 3 mm, FOV 25 × 18,8 cm (3) Axial proton density weighted FSE; TR 3000 ms, TE 19 ms, ET 15 ms, slice thickness 3 mm, FOV 25 × 12,5 cm (4) transvers fat-saturated T2-weighted; TR 4160 ms, TE 63 ms, ET 11 ms, slice thickness 3 mm, FOV 25 × 12,5 cm (5) transvers T1 weighted; TR:680 ms, TE 11ms, ET 3 ms, slice thickness 3 mm, FOV 13,2 ¥ 26,5 cm (5) coronal fat-saturated proton-density weighted; TR:3580 ms, TE 25ms, ET 7 ms, slice thickness 4 mm, FOV 17 ×17 cm. Contrast was not administered in any case, as is our routine practice. Measurements were taken from the axial section after determining the measurement level from the sagittal section (1 cm above the tibial plafond) with the ankle in a neutral position. The following measurements were taken in two groups to determine DTS morphometry (Ebraheim *et al*., 1998; Ataoglu *et al*., 2020) (Fig. 1):

- **Anterior Facet Length (AFL):** The distance from the deepest point of the incisura fibularis to the anterior tubercle was measured.
- **Posterior Facet Length (PFL):** The distance from the deepest point of the incisura fibularis to the posterior tubercle was measured.

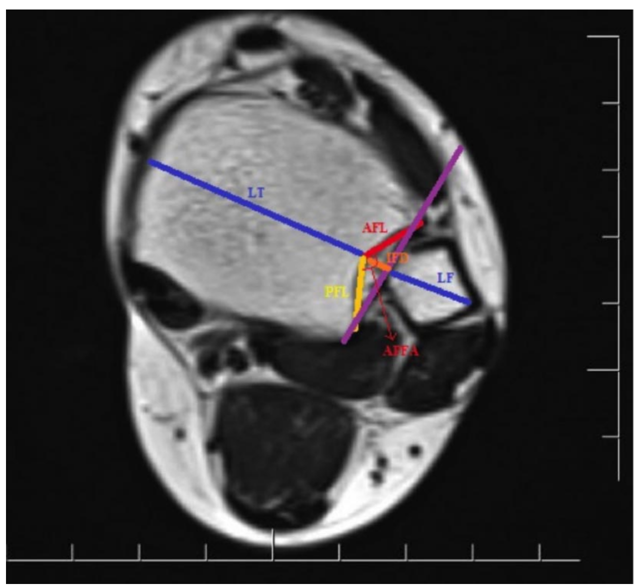

Fig. 1. DTS Morphometric Measurements on Axial MR Images. LT: Length of Tibia (Blue), LF: Length of Fibula (Blue), AFL: Anterior Facet Length (Red), PFL: Posterior Facet Length (Yellow), IFD: Incisura Fibularis Depth (Brown), APFA: Angle Between Anterior and Posterior.

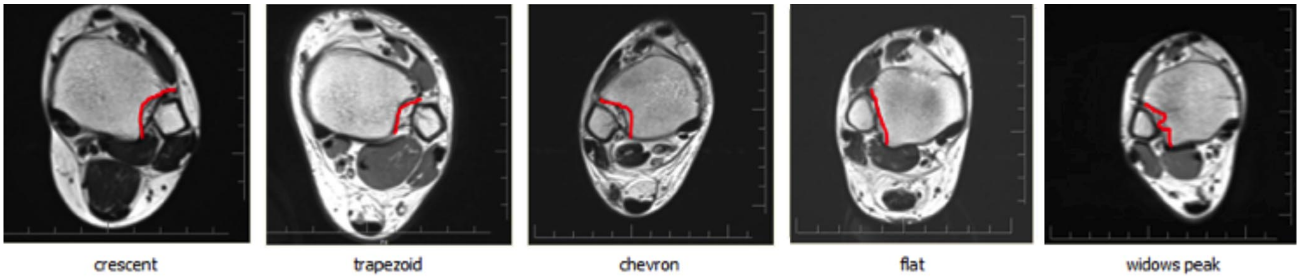

Fig. 2. Morphology of Incisura Fibularis; crescent type, trapezoid type, chevron type, flat type, widow's peak type.

- **Angle Between Anterior and Posterior Facet (APFA):** The angle between AFL and PFL was measured.
- **Incisura Fibularis Depth (IFD):** The depth of the incisura fibularis was measured by the distance from the axis passing through the anterior and posterior tubercles to the incisura fibularis.
- **Length of Tibia (LT):** The length of the tibia was measured from its outermost part to its innermost part.
- **Length of Fibula (LF):** The length of the fibula was measured from its outermost part to its innermost part.

In the study, the classification previously determined by Liu *et al*. (2018) was used to determine the morphology of the incisura fibularis. Accordingly, 5 different morphological variations for the incisura fibularis were examined in axial MRI images 1 cm above the tibial plafond: chevron (Type 1), widow's peak (Type 2), flat (Type 3), trapezoid (Type 4) and crescentic (Type 5) (Fig. 2).

Additionally, posterior tibiofibular ligament width (PTFLW) was measured on the T2-weighted sagittal MRI slice.

Statistical Analysis. For statistical analysis, the IBM SPSS statistics package program (version 26) was used. Descriptive statistics of the measurements [(mean, standard deviation (SD), minimum (min.), and maximum (max.) values)] were determined for all data. An Independent T test was used to determine the difference between groups. The Pearson Correlation test was used to determine the relationship between measurements. For determining the correlation coefficient, the following scale was accepted: 0<r≤0.19 = very weak; 0.2≤r≤0.39 = weak; 0.40≤r≤0.59 = moderate; 0.6≤r≤0.79 = strong or high; and 0.8≤r≤1 = very strong or very high relationship. P value 0.05 was considered statistically significant (Kalaycı, 2014).

RESULTS

The mean age for the patient group (n= 66; 38 females and 28 males) was 36.55±10.82 years (min. 18; max. 60), while the mean age for the control group (n=66; 41 females and 25 males) was 40.83±10.479 years (min. 18; max. 61). Descriptive statistics of the measurements are given in Table I. According to Table I, in the control group, AFL mean was

Table I. Descriptive statistics of the measurements.

Measurement	Group	N	Mean±SD	Min.	Max.	P value
	Control	66	10.9±2.4	6.0	17.6	
AFL (mm)	Ankle sprains	66	11.1±2.0	6.6	15.3	0.615
	Total	132	11.0±2.2	6.0	17.6	
	Control	66	10.2±1.8	6.8	15.3	
PFL (mm)	Ankle sprains	66	10.6±2.3	5.2	15.3	0.354
	Total	132	10.4±2.1	5.2	15.3	
	Control	66	140.26±12.33	110.00	167.00	
APFA (degree)	Ankle sprains	66	141.39±11.01	117.80	177.00	0.580
	Total	132	140.82±11.66	110.00	177.00	
	Control	66	3.2±1.2	1.1	6.5	
IFD (mm)	Ankle sprains	66	3.2±1.1	0.8	5.8	0.975
	Total	132	3.2±1.1	0.8	6.5	
	Control	66	37.4±4.4	27.3	50.5	
LT (mm)	Ankle sprains	66	38.5±3.6	32.4	49.4	0.111
	Total	132	37.9±4.1	27.3	50.5	
	Control	66	10.7±1.8	7.6	15.0	
LF (mm)	Ankle sprains	66	11.1±2.0	6.7	18.6	0.204
	Total	132	10.9±1.9	6.7	18.6	
	Control	66	5.0±1.1	2.5	8.3	
PTFLW (mm)	Ankle sprains	66	5.4±1.0	3.6	8.9	0.045
	Total	130	5.2±1.1	2.5	8.9	

10.9±2.4mm; PFL mean was 10.2±1.8mm; APFA mean was 140.26±12.33 degree; IFD mean was 3.2±1.2mm; LT mean was 37.4±4.4mm; LF mean was 10.7±1.8mm and PTFLW mean was 5.4±1.0mm, while the same measurements were found as 11.1±2.0mm, 10.6±2.3mm, 141.39±11.01 degree, 3.2±1.1mm, 38.5±3.6mm, 11.1±2.0mm and 5.4±1.0mm, respectively. A statistically significant difference was observed only in the PTFLW measurement (p=0.045), while no statistically significant difference was observed between the groups in the other measurements (Table I). The distribution of incisura fibularis morphology was observed to be mostly crescent type with 38 % in the patient group, followed by flat type with 19 %. In the control group, the most common type was flat type with 27 %, followed by crescent type with 24 % (Table II). Table III shows the comparison of the measurements to incisura fibularis

Table II. Distribution of incisura fibularis morphology according to groups.

	Incisura Fibularis Morphology						
	Chevron (Type 1)	Widow's Peak (Type 2)	Flat (Type 3)	Trapezoid (Type 4)	Crescent (Type 5)	Total	P value
Control group	11 (17 %)	7 (11 %)	13 (19 %)	10 (15 %)	25 (38 %)	66	0.523
Ankle sprain Group	11 (17 %)	9 (14 %)	18 (27 %)	12 (18 %)	16 (24 %)	66	
Total	22	16	31	22	41	132	

Table III. Comparison of measurements according to incisura fibularis morphology.

		Control group				Ankle Sprains Group			
Measurements	Type	N	Mean±SD	(Min-Max)	P value	N	Mean±SD	(Min-Max)	P value
AFL (mm)	1	11	12.0±2.8	8.7-17.6	0.014	11	12.0±2.0	9.1-15.3	0.027
	2	7	12.9±1.9	9.4-15.8		9	10.9±2.4	6.7-13.6	
	3	13	10.6±2.4	7.5-16.2		18	11.0±1.5	8.5-14.4	
	4	10	9.3±2.8	6.0-15.7		12	9.7±1.8	6.6-12.8	
	5	25	10.8±1.6	7.7-14.1		16	11.8±1.9	8.9-14.5	
	Total	66	10.9±2.4	6.0-17.6		66	11.1±2.0	6.6-15.3	
PFL (mm)	1	11	10.7±2.0	8.4-14.5	0.074	11	10.0±1.5	8.5-13.6	0.293
	2	7	11.4±2.7	6.8-15.3		9	10.6±2.5	6.3-13.0	
	3	13	10.2±1.4	8.3-13.1		18	9.8±1.5	7.7-13.0	
	4	10	10.8±2.0	6.8-13.2		12	11.0±3.7	5.2-15.3	
	5	25	9.5±1.4	7.5-12.8		16	11.4±1.8	7.9-14.1	
	Total	66	10.2±1.8	6.8-15.3		66	10.6±2.3	5.2-15.3	
APFA (degree)	1	11	139.12±10.22	119.60-157.00	<0.001	11	132.55±9.39	118.40-148.10	<0.001
	2	7	143.09±14.86	128.00-162.00		9	142.54±9.51	126.80-157.30	
	3	13	154.52±8.21	139.60-167.00		18	152.59±8.26	144.60-177.00	
	4	10	135.33±6.84	123.00-148.01		12	138.41±9.50	117.80-150.80	
	5	25	134.52±10.22	110.00-154.00		16	136.44±5.75	122.20-143.10	
	Total	66	140.26±12.33	110.00-167.00		66	141.39±11.01	117.80-177.00	
IFD (mm)	1	11	3.8±1.0	2.0-5.3	<0.001	11	4.3±0.9	2.9-5.8	<0.001
	2	7	3.4±1.6	1.3-6.0		9	3.2±1.1	1.8-4.8	
	3	13	2.0±0.5	1.1-2.9		18	2.2±0.7	0.8-3.3	
	4	10	3.3±0.8	1.9-4.6		12	2.9±0.6	1.9-3.8	
	5	25	3.5±1.0	1.9-6.5		16	3.8±0.8	2.9-5.6	
	Total	66	3.2±1.2	1.1-6.5		66	3.2±1.1	0.8-5.8	
LT (mm)	1	11	38.4±3.5	33.5-43.9	0.331	11	38.7±2.6	33.3-42.8	0.669
	2	7	39.9±5.6	31.9-48.9		9	39.9±5.0	33.0-49.4	
	3	13	37.3±4.4	27.3-45.4		18	38.5±3.4	32.4-44.2	
	4	10	37.3±4.3	30.0-45.4		12	38.3±3.9	33.1-44.7	
	5	25	36.2±4.3	30.1-50.5		16	37.6±3.6	32.5-44.7	
	Total	66	37.4±4.4	27.3-50.5		66	38.5±3.6	32.4-49.4	
LF (mm)	1	11	11.7±1.6	8.3-14.8	0.061	11	10.6±1.5	7.1-13.0	0.215
	2	7	10.0±2.5	7.8-15.0		9	11.3±1.1	9.8-13.2	
	3	13	9.9±1.4	7.8-12.6		18	11.7±2.8	8.5-18.6	
	4	10	10.1±1.8	7.6-12.6		12	10.1±1.7	6.7-12.6	
	5	25	11.1±1.7	8.3-14.8		16	11.5±1.5	8.9-14.3	
	Total	66	10.7±1.8	7.6-15.0		66	11.1±2.0	6.7-18.6	
PTFLW (mm)	1	11	4.9±0.7	3.9-5.9	0.863	11	5.3±0.8	4.4-7.7	0.983
	2	7	5.1±1.9	2.5-8.3		9	5.5±1.5	4.0-8.9	
	3	13	4.8±1.1	2.9-6.3		18	5.3±1.0	3.6-7.4	
	4	10	5.3±1.5	3.0-7.8		12	5.4±1.1	3.8-7.4	
	5	25	5.0±1.0	3.0-7.4		16	5.5±0.9	3.9-7.0	
	Total	66	5.0±1.1	2.5-8.3		66	5.4±1.0	3.6-8.9	

morphology. Accordingly, AFL, APFA and IFD measurements were found to be statistically significant ($p<0.05$) in both groups according to their morphology, while PFL, LT, FT and PTFLW measurements were not found to be statistically significant ($p>0.05$) (Table III). According to the Pearson Correlation Test, a weak negative and statistically significant relationship was found between sex and AFL ($r=-0.249$; $p=0.044$), PTFLW ($r=-0.264$; $p=0.035$) measurements in the patient group. In addition, a weak and statistically significant relationship was found between AFL and PTFLW ($r=0.362$; $p=0.003$) measurements in the ankle sprains group, while a moderate and statistically significant relationship was found between LT and PTFLW ($r=0.522$; $p<0.001$) (Tables IV and V).

Table IV. Relationship Between Measurements According to Pearson Correlation in Control Group.

Parameters	r value	Age	Sex	AFL	PFL	APFA	IFD	LT	LF	Type	PTFLW
Age	r	1									
	p										
Sex	r	0.066	1								
	p	0.601									
AFL	r	0.037	-0.233	1							
	p	0.767	0.060								
PFL	r	-0.001	-0.266	0.162	1						
	p	0.992	0.031	0.194							
APFA	r	0.005	-0.004	-0.018	-0.122	1					
	p	0.971	0.974	0.887	0.330						
IFD	r	0.056	-0.096	0.371	0.277	-0.771	1				
	p	0.657	0.441	0.002	0.025	<0.001					
LT	r	0.168	-0.619	0.511	0.448	0.019	0.206	1			
	p	0.177	<0.001	<1.001	<0.001	0.881	0.097				
LF	r	0.078	-0.099	0.401	0.343	-0.238	0.528	0.417	1		
	p	0.532	0.430	0.001	0.005	0.054	<0.001	<0.001			
Type	r	-0.065	0.183	-0.266	-0.271	-0.275	0.015	-0.229	-0.024	1	
	p	0.602	0.141	0.031	0.028	0.025	0.904	0.064	0.848		
PTFLW	r	0.106	-0.034	-0.032	-0.025	-0.061	0.033	-0.004	0.120	0.067	1
	p	0.399	0.784	0.796	0.840	0.628	0.790	0.974	0.337	0.595	

Table V. Relationship Between Measurements According to Pearson Correlation in Ankle Sprains Group.

Parameters	r value p value	Age	Sex	AFL	PFL	APFA	IFD	LT	LF	Type	PTFLW
Age	r	1									
	p										
Sex	r	0.129	1								
	p	0.301									
AFL	r	-0.106	**-0.249**	1							
	p	0.398	**0.044**								
PFL	r	-0.123	**-0.269**	0.169	1						
	p	0.326	**0.029**	0.175							
APFA	r	-0.016	0.006	-0.094	0.076	1					
	p	0.902	0.962	0.454	0.545						
IFD	r	0.001	-0.222	**0.305**	**-0.215**	**-0.762**	1				
	p	0.997	0.073	**0.013**	**0.083**	**<0.001**					
LT	r	-0.153	**-0.706**	**0.318**	-0.161	0.087	0.138	1			
	p	0.221	**<0.001**	**0.009**	0.197	0.487	0.267				
LF	r	0.085	0.024	0.107	-0.012	0.131	-0.104	0.153	1		
	p	0.495	0.849	0.391	0.923	0.293	0.405	0.219			
Type	r	0.122	0.144	-0.070	-0.075	-0.010	-0.082	-0.146	0.066	1	
	p	0.328	0.248	0.578	0.550	0.936	0.511	0.243	0.598		
PTFLW	r	-0.029	**-0.264**	**0.362**	-0.147	-0.023	0.154	**0.522**	0.015	0.035	1
	p	0.823	**0.035**	**0.003**	0.247	0.858	0.223	**<0.001**	0.905	0.786	

DISCUSSION

The basis of the study is the question of whether ankle sprains are affected by the DTS morphology and morphometry. Morphologically, we found that the incisura fibularis was mostly crescent (38 %) in the control group, while it was mostly flat (27 %) in the patient group with ankle sprains. In particular, we believe that the cause of ankle sprain is not due to the morphology of the incisura fibularis, but considering the findings, the flat shape is a risk factor for ankle sprain. However, statistically, no significant difference was found between the groups in terms of morphology (p=0.523). In addition, statistically significant differences were observed between the AFL, APFA, and IFD measurements of the incisura fibularis morphological shapes in both the patient and control groups (p<0.05). We believe that the reason for this difference is the measurements that reveal the morphological shapes. Indeed, the correlation test reveals a weakly significant relationship between incisura fibularis types and AFL, PFL, and APFA. The study also found that the APFA angle increased in patients with ankle sprains (range 117.80 mm - 177.00 mm) compared to the control group (range 110.00 mm - 167.00 mm). It is assumed that this result also caused morphological changes. However, the study did not record large enough differences in morphometric measurements to create statistically significant differences.

While DTS plays an important role for ankle stability, its damage leads to instability problems. In fact, in a study, it was determined that a 1 cm lateral shift of the talus meant a 42 % decrease in the connection area with the tibial joint. Studies claim that DTS morphology plays an important role in ankle injuries. While there are studies suggesting that the depth of the incisura fibularis affects ankle injuries, there are also studies showing that ATFL damage occurs first in syndesmosis injuries. Syndesmosis morphology has been subjected to different classifications in studies (Ramsey & Hamilton, 1976; Hermans *et al*., 2010; Elgafy *et al*., 2010). In the study conducted by Elgafy *et al*. (2010), they divided the syndesmosis morphology into two: Shallow and crescent, and recorded 67 % as crescent and 37 % as shallow. Boszczyk *et al*. (2019), divided it into deep and shallow, while Bhagat *et al*. (2024), divided it into concave (54 %) and shallow (46 %). Similarly, Tonogai *et al*. (2017), divided into two concave and shallow and determined 64 % concave and 36 % shallow. In another study, Ataoglu *et al*. (2020), divided the DTS morphology into 3: Flat type, V type, and crescent type. Here we see the V type in addition to other studies. Similarly, Liu *et al*. (2017), divided it into 3 but added the "C" shape and "I" shape as well as the "┌" shape. Again, the "C" shape (56 %) was the most common in the normal population, followed by the "I" shape (25 %) and the least by the "┌" shape (19 %). In recent studies, Liu *et al*. (2018), and Huang *et al*. (2023, divided the DTS morphology into 5 in more detail than other studies. Huang *et al*. (2023), determined the DTS morphology as chevron (19.7 %), widow's peak (16.3 %), flat (22.4 %), trapezoid (21.8 %), and crescent (19.7 %), while Liu *et al*. (2018), determined the DTS morphology as crescentic 61.3 %, trapezoid, 25.1 %, chevron 6.8 %, widow's peak 3.7 %, and flat 3.1 %. In our study, the incisua fibularis shape was divided into 5 groups similar to the studies of Liu *et al*. (2017, 2018) and Huang *et al*. (2023), and the crescent type (38 %) was seen most in the control group, while the flat type (27 %) was seen most in the patient group. In this case, we suggest that the DTS morphology is a risk factor for ankle sprains.

Studies have shown that the depth of the incisura fibularis is a risk factor for ankle instability. In the study where Boszczyk *et al*. (2019), compared the syndesmosis injury group and the control group, they found the incisura fibularis depth to be 3.3±1.3 for the syndesmosis injury group, while this value was 4.0±1.2 in the control group, and found a statistically significant difference between them (p=0.002). In the study with 3-dimensional measurements, Huysse *et al*. (2021), compared the incisura fibularis depth in patients with unstable high ankle sprains with the control group, and found it to be 3.8±1.1 mm for the patient group, while it was 4.8±1.1 mm for the control group, and found a statistically significant difference between them (p=0.015). In both of these studies, we see that the syndesmosis injury is more serious than in our study. Because in our study, although there was an the ATFL tear in the selected patient group, the PTFL was intact but thickened due to the damage. It is known that the first ligament to tear in strain is the ATFL, and that a stronger force is needed for the PTFL to tear (Hermans *et al*., 2010). When we evaluate our study findings, we believe that this is the reason we did not find a statistically significant difference in the depth of the incisura fibularis (the mean depth of the incisura fibularis was 3.2±1.2 mm (range 1.1 mm - 6.5 mm) in the control group and 3.2±1.1 mm (range 0.8 mm - 5.8 mm) in the patient group. It is noteworthy that the minimum and maximum values of the incisura fibularis depth parameter are lower in the patient group than in the healthy group.

There are some limitations in our study. Patients with ATFL tears were included in our study, but adding a group where both ATFL and PTFL were torn and a group with syndesmosis injuries would have strengthened our study. In addition, increasing the number of subjects would have been useful for comparing DTS morphological groups.

In conclusion, we found that DTS morphology is a risk factor for ankle sprains in our study. While the crescent type is more common in normal individuals, the shallow type is more common in patients with ankle sprains. We believe that our study can provide insight to clinicians and surgeons working in this field with both the reference values of DTS and the results of the relationship between ankle sprains and DTS morphology.

ÖZSAHIN, E.; POLAT, S.; ALTUN, Z.; TUNÇ, M. & GÖKER, P. Evaluación de la morfología de la sindesmosis tibiofibular distal en esguinces de tobillo. *Int. J. Morphol., 43(1)*:14-20, 2025.

RESUMEN: Se sugiere que existe una conexión entre el tobillo y la sindesmosis tibiofibular distal (STFD) y las posibles diferencias en la morfología de la STFD pueden ser una razón de inestabilidad. Este estudio tiene como objetivo evaluar la morfología de la STFD en pacientes con esguinces de tobillo desde el punto de vista radiológico y anatómico. En el estudio, se compararon las imágenes de RM de 66 pacientes diagnosticados con esguince de tobillo con las de 66 pacientes sanos del grupo control. La longitud de la faceta anterior (LFA), la longitud de la faceta posterior (LFP), el ángulo entre la faceta anterior y posterior (AFAP), la profundidad de la incisura fibular (PIF), la longitud de la tibia (LT) y la longitud de la fíbula (LF) se midieron a 1 cm por encima del plafón tibial. Además, la morfología del STFD se clasificó como chevron, punto en forma de v (pico de viuda en inglés), plano, trapezoide y creciente y se examinó si afectaba al esguince de tobillo. Además, se examinó el ancho del ligamento tibiofibular posterior (ALTFP). La edad media del grupo de pacientes (n = 66; 38 mujeres y 28 hombres) fue de 36,55 ± 10,82 años, mientras que la edad media del grupo de control (n = 66; 41 mujeres y 25 hombres) fue de 40,83 ± 10,48 años. En el grupo de control, las medias de LFA, LFP, AFAP, PIF, LT, LF y ALTFP fueron 10,9 ± 2,4 mm, 10,2 ± 1,8 mm, 140,26 ± 12,33 grados, 3,2 ± 1,2 mm, 37,4 ± 4,4 mm, 10,7 ± 1,8 mm y 5,4 ± 1,0 mm, respectivamente, mientras que las mismas medidas fueron 11,1 ± 2,0 mm, 10,6 ± 2,3 mm, 141,39 ± 11,01 grados, 3,2 ± 1,1 mm, 38,5 ± 3,6 mm, 11,1 ± 2,0 mm y 5,4 ± 1,0 mm en sujetos con esguinces de tobillo, respectivamente. Se observó que la distribución de la morfología de la incisura fibular era mayoritariamente de tipo creciente con un 38 % en el grupo de pacientes, seguida del tipo plano con un 19 %. En el grupo control, el tipo más común fue el tipo plano con un 27 %, seguido del tipo creciente con un 24 %. Este artículo encontró que la morfología de STFD podría ser un factor de riesgo para los esguinces de tobillo. Además, la morfología de la incisura se mostró entre sujetos sanos y pacientes con esguinces de tobillo. Mientras que el tipo creciente es más común en individuos normales, el tipo superficial es más común en pacientes con esguinces de tobillo.

PALABRAS CLAVE: Esguinces de tobillo; Sindesmosis tibiofibular distal; Morfología.

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