Weight-Bearing CT Can Effectively Diagnose Syndesmotic Instability in Patients with Weber B Ankle Fractures

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Purpose: Diagnosing syndesmotic instability accompanying Weber B ankle fractures is critical toward optimizing clinical outcome. We aimed to evaluate the diagnostic sensitivities of distances, area, and volumetric measurement of the injured syndesmotic joint on weight-bearing CT (WBCT) among patients having unilateral Weber B ankle fractures with surgically confirmed syndesmotic instability.

Methods: Patients with unilateral surgically confirmed syndesmotic instability accompanying type B malleolar fracture (n = 24) having preoperative bilateral ankle WBCT were included in the patient group. A separate group of patients with unilateral Weber B ankle fractures without syndesmotic instability confirmed operatively and having similar imaging were included as controls (n = 18). With the uninjured side serving as an internal control, measurements included: (1) syndesmotic area; (2) distances between the anterior, middle, and posterior quadrants within the incisura; (2) fibular rotation; (3) fibular length; (4) fracture displacement; (5) syndesmotic joint volume from the tibial plafond extending until 3 cm and 5 cm proximally; and (6) medial and lateral clear space volume.

Results: Among patient groups, all WBCT measurements except syndesmotic area as well as anterior and posterior difference within the incisura were increased on the injured as compared to the uninjured side (*P* values <0.001 to 0.004). Of these measurements, syndesmosis volumetric measurements spanning until 3 cm and 5 cm proximally had the highest relative ratio between the injured and uninjured side (*P* values = 0.001 to 0.036). In the control group, all WBCT parameters except for medial clear space volume showed no differences between the 2 sides.

Conclusion: WBCT scan can effectively diagnose syndesmotic instability among patients with Weber B ankle fractures. Syndesmosis volumetric measurements seem to be best suited to diagnose subtle instability compared to other WBCT measurements.

Table 1. Bilateral differences in weightbearing CT measurements in the patient group.

Measurement	Patient group (n=24)		Difference between the injured and uninjured ankle	95% CI	Median Ratio (IQR)*	p-value
	Injured side (mean ± SD)	Uninjured side (mean ± SD)				
Syndesmosis volume up to 3cm above TP (cm^3)	5.9±1.2	4.3±0.8	1.6	[1.2-2.1]	1.4 (1.2-1.4)	< 0.001
Syndesmosis volume up to 5cm above TP (cm^3)	12.7±2.1	9.2±1.1	3.5	[2.9-4.1]	1.4 (1.3-1.5)	< 0.001
MCS volume (mm^3)	677.9±165.2	547.3±145.2	130.6	[105.4-155.8]	1.3 (1.1-1.3)	< 0.001
LCS volume (cm^3)	3.6±0.9	3.0±1.0	0.6	[0.7-6.4]	1.2 (1.1-1.3)	< 0.001
Syndesmotic area (mm^2)	117.3±23.0	109.2±23.3	8.1	[-0.5-16.6]	1.1 (1.0-1.2)	0.07
Anterior difference within the incisura (mm)	4.5±1.8	4.4±0.9	0.1	[-0.7-0.9]	1.0 (0.7-1.2)	0.77
Middle difference within the incisura (mm)	4.4±1.0	3.7±0.7	0.7	[0.4 – 1.1]	1.2 (1.0-1.4)	< 0.001
Posterior difference within the incisura (mm)	9.6±2.5	9.0±1.3	0.6	[-0.5-1.8]	1.1 (0.9-1.2)	0.25
Fibular rotation (degrees)	13.2±4.4	10.3±3.7	2.9	[2.2-3.7]	1.3 (1.2-1.4)	< 0.001
Fibular length (mm)	22.5±2.5	24.9±2.8	2.4	[1.8-3.0]	0.9 (0.8-1.0)	< 0.001
Navicular to floor distance (mm)	26.9±6.3	25.2±5.9	1.7	[0.6-2.9]	-	0.004

Abbreviations: WBCT, weightbearing computed tomography; MCS, medial clear space; LCS, lateral clear space; TP, tibial plafond; SD, standard deviation; IQR, Interquartile range.
* Ratio: WBCT measurements in injured ankle/contralateral uninjured ankle