

instability and therefore all were indicated for arthroscopy [15]. For every syndhoo-tested athlete, an arthroscopy was performed by 1 experienced ankle surgeon at our Center between January 2017 and September 2017. During arthroscopy, the syndesmosis was considered positive (unstable) if a 4.5 mm arthroscopic shaver could be pushed through the distal syndesmosis, 1 cm proximal from the tibiotalar joint. The physiotherapist and surgeon were blinded to the other one's results. All patients were tested and treated between 1 and 4 weeks from the initial injury.

The principle of this syndhoo device is to dynamically evaluate the distal tibiofibular stability during external rotation of the ankle as an extension to the available clinical tests. Cadaveric testing has shown that the distal syndesmosis is unstable when a force of 87-100 N is applied. The foot is positioned and fixed on the syndhoo board that rotates over the heel (Figures 1A and 1B). The board can be put in neutral position, 20 degrees of plantar flexion and 20 degrees of dorsiflexion (Figures 1C and 1D). The knee is stabilized through a patellar strap and the patient is tested in sitting position (Figure 1B). With a dynamometer, the foot is passively externally rotated with the hinge positioned over the heel (Figures 1E and 1F). When the patient experiences clinical apprehension at a force <87 N, the syndhoo test is considered positive. If the apprehension occurs during a force 87-100N, the syndhoo test is considered equivocal. When no apprehension occurs or the apprehension occurs with a force >100N, the syndhoo test is considered negative.

Statistically, Cohen's kappa (κ) has been used to determine the inter-rater agreement between the arthroscopy method (as a reference) and the three syndhoo methods (dorsiflexion, neutral, plantar flexion). Based on the guidelines from Altman, and adapted from Landis & Koch, Cohen's kappa (κ) is interpreted as poor agreement if less than 0.20, fair agreement if between 0.20 to 0.40, moderate agreement if between 0.40 to 0.60, good agreement if between 0.60 to 0.80, and very good agreement if between 0.80 to 1.00.



Figure 1A: Image of the syndhoo device (front side).



Figure 1B: Image of the syndhoo device from the side with the foot placed on the rotating board in neutral position.

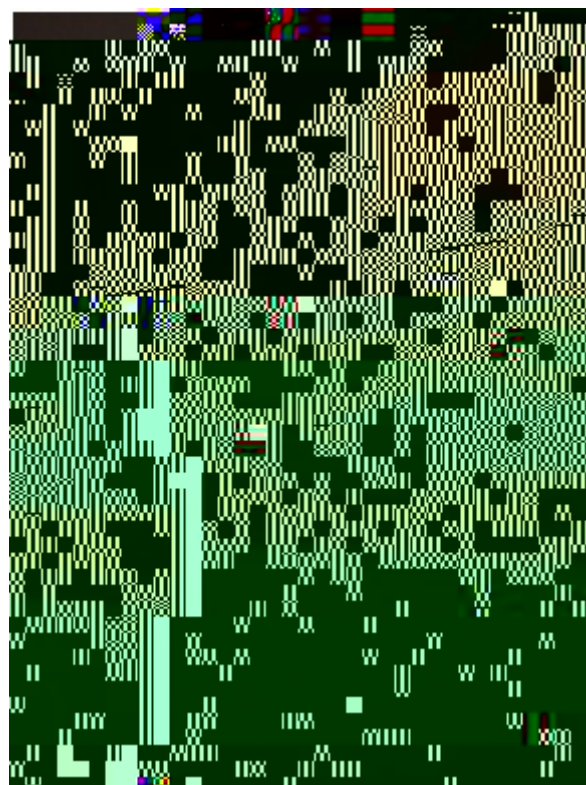


Figure 1C: Image of the syndhoo device from the side with the foot placed on the rotating board in 20 degrees of plantar flexion.



Figure 1D: Image of the syndhoo device from the side with the foot placed on the rotating board in 20 degrees of dorsiflexion.



Figure 1F: Overview image of the dynamometer; linked to the rotating board.

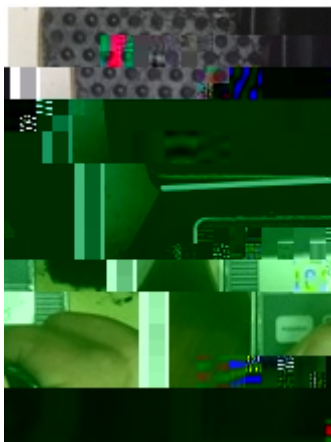


Figure 1E: Image close up of the dynamometer; placed at the medial foot side of the rotating board.

Results

Syndhoo dorsiflexion: when pushing manually the dynamometer in external rotation (with the board in 20 degrees of dorsiflexion), the test is considered positive if the athlete feels apprehension at a force <87 Newton (N)

Syndhoo neutral: when pushing manually the dynamometer in external rotation (with the board in neutral position), the test is considered positive if the athlete feels apprehension at a force <87 Newton (N)

Syndhoo plantar flexion: when pushing manually the dynamometer in external rotation (with the board in 20 degrees of plantar flexion), the test is considered positive if the athlete feels apprehension at a force <87 Newton (N).

The descriptive results of the four types of diagnosis are presented in Table 1.

Subject ID	Left	Right
	Ankle	Ankle

21. van Dijk CN, Longo UG, Loppini M, Florio P, Maltese L, et al. (2016) Conservative and surgical management of acute isolated syndesmotic injuries: ESSKA-AFAS consensus and guidelines. *Knee Surg Sports Traumatol Arthrosc* 24: 1217-1227.
22. Nussbaum ED, Hosea TM, Sieler SD, Incremona BR, Kessler DE (2001) Prospective evaluation of syndesmotic ankle sprains without diastasis. *Am J Sports Med* 29: 31-35.
23. Hopkinson WJ, St Pierre P, Ryan JB, Wheeler JH (1990) Syndesmosis sprains of the ankle. *Foot Ankle* 10: 325-330.
24. Sman AD, Hiller CE, Refshauge KM (2013) Diagnostic accuracy of clinical tests for diagnosis of ankle syndesmosis injury: A systematic