

**Automated Volume Measurement of the Syndesmosis Using 3D Weight-Bearing CT**

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**Purpose:** Recent studies have shown that weight-bearing CT (WBCT) that allows 3-dimensional (3D) volume measurement of the distal syndesmosis while under physiologic load brings about a higher accuracy in detection of syndesmotic instability, especially if subtle. Since the volume measurement method is complex, time-consuming, and has a noticeable interobserver bias, most clinicians might not still be interested in utilizing it in practice. Automatization of this measurement using computer-assisted methods will not only reduce the interobserver bias but also will be faster and more applicable in practice. This study aimed to develop an automated 3D syndesmosis volume measurement tool using image processing methods and compare the speed and the interobserver bias with human interpreters.

**Methods:** Herein, we included 30 patients with subtle syndesmotic instability who had undergone WBCT and were diagnosed intraoperatively. 30 individuals with otherwise healthy ankles who had WBCT images were allocated to the control group. The volume measurement up to 5 cm proximal to the tibial plafond was considered the most sensitive and specific method to assess syndesmotic stability based on the literature. An algorithm was developed using MATLAB software that could recognize and calculate the syndesmotic volume using WBCT images. The volume measurement method was used by two orthopaedic surgeons for the same population. The time spent by each surgeon and the algorithm was measured. Finally, the values were compared using the t test; the interobserver correlation coefficient (ICC) was also calculated.  $P < 0.05$  was considered statistically significant.

**Results:** There was no significant difference regarding the demographic data of the two groups. The ICC between the clinicians was 75%, while using the algorithm showed 97%. The mean time spent by the clinicians was  $268.4 \pm 56.4$  and by the algorithm was  $2.9 \pm 0.3$  seconds ( $P < 0.001$ ).

**Conclusion:** Developing a faster and more accurate method for 3D volume measurement of the syndesmosis renders this method more practically reliable and easier to use by the clinicians.