Validation of Digital Photography for Limb Volume Measurement

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Context: Assessment of swelling allows athletic trainers to quantify the severity of an injury, and evaluate the progress during rehabilitation. Water volumetric method (WVM) is considered the clinical “gold standard” quantification of limb volume. This method requires specialized equipment and is time consuming to perform. Objective: The purpose of this study was to compare a novel method of volume assessment using digital images (DI) to estimate limb volume using pixel counts from DI. Design: Cross-sectional Setting: Sports Medicine Research Laboratory Participants: A convenience sample of 10 participants with no history of lower limb injury was used (6 male, 4 female, age = 28.5 ±15.5 years, height = 163±13.2 cm, weight = 72±36 kg) Interventions: DI on the lateral aspect of the foot/ankle were analyzed for pixel count using ImageJ software. (DI reliability, ICC = 0.964) A linear tape measure was used to measure ankle circumference using the lateral malleolus as the start and end point consistent with current clinical practice. WVM was measured by immersing the limb into a foot volumeter and weighing displaced water using a digital scale. SPSS was used to analyze the data using partial least squares regression and two-way random, absolute agreement Intraclass Correlation Coefficient. (ICC 2,1) Main Outcome Measures: ELV was derived using the regression equation developed in SPSS and then was compared to WVM. Results: The following equation was developed to estimate limb volume: [DI= 1329.5+314.2*(body mass)+14.2*(ankle circumference) +0.0033*(pixel count)]. In comparing WVM to DI an ICC 2,1 = 0.995 was calculated. Conclusions: Digital photography accurately measures lower limb volumes closely agreeable to the measurements of the “gold standard” method. With the advent of camera phone technology, there is wide spread availability of digital photography equipment among athletic trainers. This method may be more efficient and cost-effective than volumetric measurement to record and monitor limb volumes post-injury. Word Count: 306