FOOT MEASUREMENTS are widely performed for purposes of orthotic prescription and to aid in discovering possible risk factors or causes of sport-related injuries. There is little information in the literature on foot measurement in a weight-bearing condition. Many clinicians measure navicular drop when evaluating foot structure. This measurement is obtained with the subtalar joint in neutral. Subtalar-joint neutral is described as a position in which the foot is neither pronated nor supinated. Unfortunately, this position might feel unnatural. Reported estimates of the measurement’s reliability vary. The arch index provides an alternative method of quantifying foot structure during weight bearing.

In 2000, Williams and McClay compared several individual foot measurements and ratios and determined that height of the dorsum of the foot at 50% of the total foot length divided by truncated foot length (length from the most posterior portion of the calcaneus to the first metatarsophalangeal joint) was consistently the most valid and reliable method of foot measurement. The use of these structural measures is in agreement with previous research by Saltzman et al., who initially described the technique of taking anthropometric measures and comparing them with radiographic measures, similar to the methods later used by Williams and McClay. Based on high correlations between clinical and radiographic measures in a natural weight-bearing stance, Saltzman et al. recommended that the medial longitudinal arch be described using a ratio of navicular height to truncated foot length. After further research, Williams and McClay revised this recommendation to the use of height of the dorsum instead of the navicular to increase intertester reliability in both a loaded (90% body weight) and a relatively unloaded (10% body weight) condition. Subsequent studies have used this arch-height index to relate foot structure to injury patterns and kinematic and kinetic differences among runners.
**Measurement Technique**

Before measurement, an athlete’s body weight is recorded, and 10% and 90% of body weight are calculated. Ten percent and ninety percent of weight bearing are considered to be representative of a non-weight-bearing and full-weight-bearing position, respectively. The athlete stands with one foot positioned on a platform that has been placed atop a scale. The other foot is placed on an adjacent surface of equal height (Figure 1). The Arch Height Index Measurement System (JAK Tool & Model, Matawan, NJ) is then placed on the platform and the examiner measures the total foot length and truncated foot length and locates the midpoint of the total foot length (Figure 1). While the athlete stands on the platform he or she holds on to a countertop to maintain balance and to adjust the reading on the scale to the calculated values of 10% and 90% weight bearing. The height of the dorsum of the foot at 50% of the total foot length is measured under each of the two weight-bearing conditions. The examiner must carefully observe to make sure that the athlete does not lean his or her body or bend the knee in a manner that might alter the height of the dorsum beyond the change that results from varying the percentage of body weight applied to the foot.

If the ratio is 0.356 or greater, the foot is considered high arched, and if measurements are less than or equal to 0.275, the foot is classified as low arched.4,5 These values were previously reported to be 1.5 SD above or below the mean arch ratio of 0.316 ± 0.027 at 10% of weight bearing.2 Arch mobility can be evaluated by calculating the change in arch-index ratio between weight conditions.

**Clinical Implications**

There are several advantages to using an arch-index ratio of height of the dorsum at 50% total foot length to truncated foot length. First, this method has been reported to be valid when compared with radiographic measurements and has high intratester and intertester reliability at both 10% and 90% weight bearing—ICC(2,k) = .811 or more.2 Normative data are also available, which research have shown to be related to differences in kinematics and injury patterns between high- and low-arched individuals.2,4,5 The description of this device and the measurement technique might be helpful to clinicians in determining whether patients should be classified as high arched or low arched. For example, it has been reported that high-arched runners are at greater risk of injuring bony structures on the lateral aspect of the lower extremity and foot, and low-arched individuals are at increased risk of soft-tissue damage on the medial side of the lower extremity and knee.4

**References**


Jennifer Howard is a recent graduate of the Department of Rehabilitation Sciences Division of Athletic Training, University of Kentucky.

Dustin Briggs is head athletic trainer for Des Moines Buccaneers Hockey and Work Systems Rehab & Fitness in Pella, IA.