

The First Ray Measuring Device

by Thomas C. Michaud, DC

Practitioners have long realized that a thorough evaluation of first ray motion and position is an essential part of a biomechanical exam. Unfortunately, evaluation has always relied upon inaccurate methods of visually approximating dorsi-plantar motion and categorizing first rays as flexible, semi-flexible or rigid (Fig. 1). The first ray measuring device (FMRD) was designed to correct this problem by allowing for more precise evaluation of the static and dynamic function of the first ray.

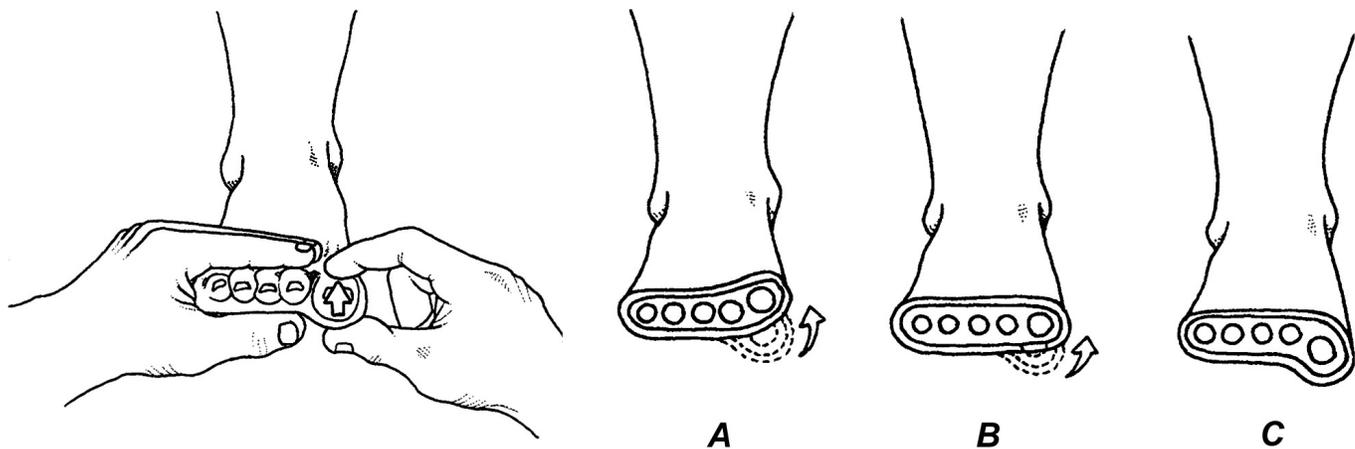


Fig. 1. Categorization of the plantarflexed first rays. The first ray is maximally dorsiflexed as the lesser metatarsals are held stationary. If the first ray can dorsiflex above the common transverse plane of the lesser metatarsals (**A**), it is referred to as a flexible deformity. If it dorsiflexes to the same level as the lesser metatarsals (**B**), it is a semiflexible deformity, and if it is unable to reach the common transverse plane of the lesser metatarsals (**C**), it is a rigid deformity.

To use the device in the evaluation of dynamic function, place the superior surface of the device beneath the metatarsal heads so the nylon screw points medially and the vertical bisection line is positioned directly beneath the first and second metatarsal heads. Your thumb should be placed inside the lateral aspect of the device (while gripping the dorsal metatarsal heads with the index and middle fingers) as the thumb and index of the opposite hand hold the device. While holding the lateral metatarsals and the device securely in one hand, push the other side of the device straight up until a firm end-feel is noticed (Fig. 2).

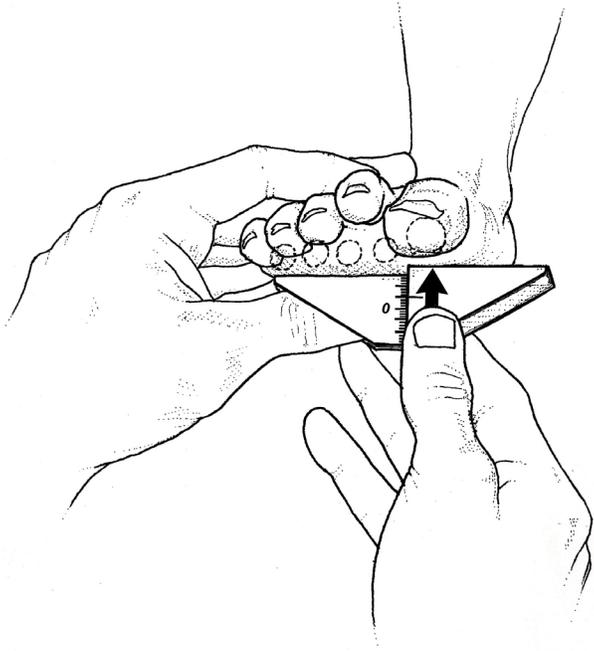


Fig. 2. Using the First Ray Measuring Device to evaluate motion.

Observe the millimeters of motion and quickly repeat the measurement a few times to ensure reproducibility. As you repeat the measurement, make sure the device is straight (i.e., the device should be parallel to the forefoot and perpendicular to the leg) and the force that is applied with the thumb and index on the moving portion of the device should be applied as close as possible to the bisection line. It is also important that the force is applied straight up; i.e., the device should not tilt when you take your measurement. With practice, it is easy to get consistent readings. Depending on the size of the foot, a hypomobile first ray typically possesses less than 4 mm of motion while a hypermobile first ray typically has greater than 6 mm. Because the difference in motion between a normal and hypermobile first ray is so small, a thumb-radius index measurement should always be used as a back-up measurement (Fig. 3).

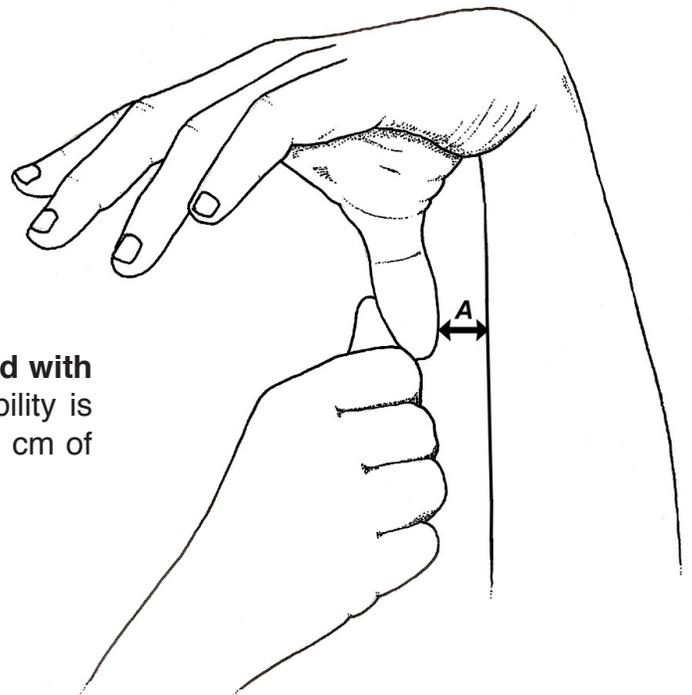


Fig. 3. The thumb to radius index (A) is measured with the wrist flexed and radially deviated. Hypermobility is present when the thumb can be positioned within 2 cm of the radius.

In addition to measuring dorsi-plantar motion, the FRMD also allows for precise evaluation of the static position of the first metatarsal head. Simply place the prone patient in a neutral position and, while holding the lateral column with your thumb, maneuver the device with the free hand so one side parallels the second through fifth metatarsal heads while the other side is positioned beneath the plantarflexed metatarsal head (Fig. 4). As with all measurements, make sure the device does not tilt as you are taking the measurement. Noting the exact degree of a plantarflexed first ray allows you to precisely balance the deformity.

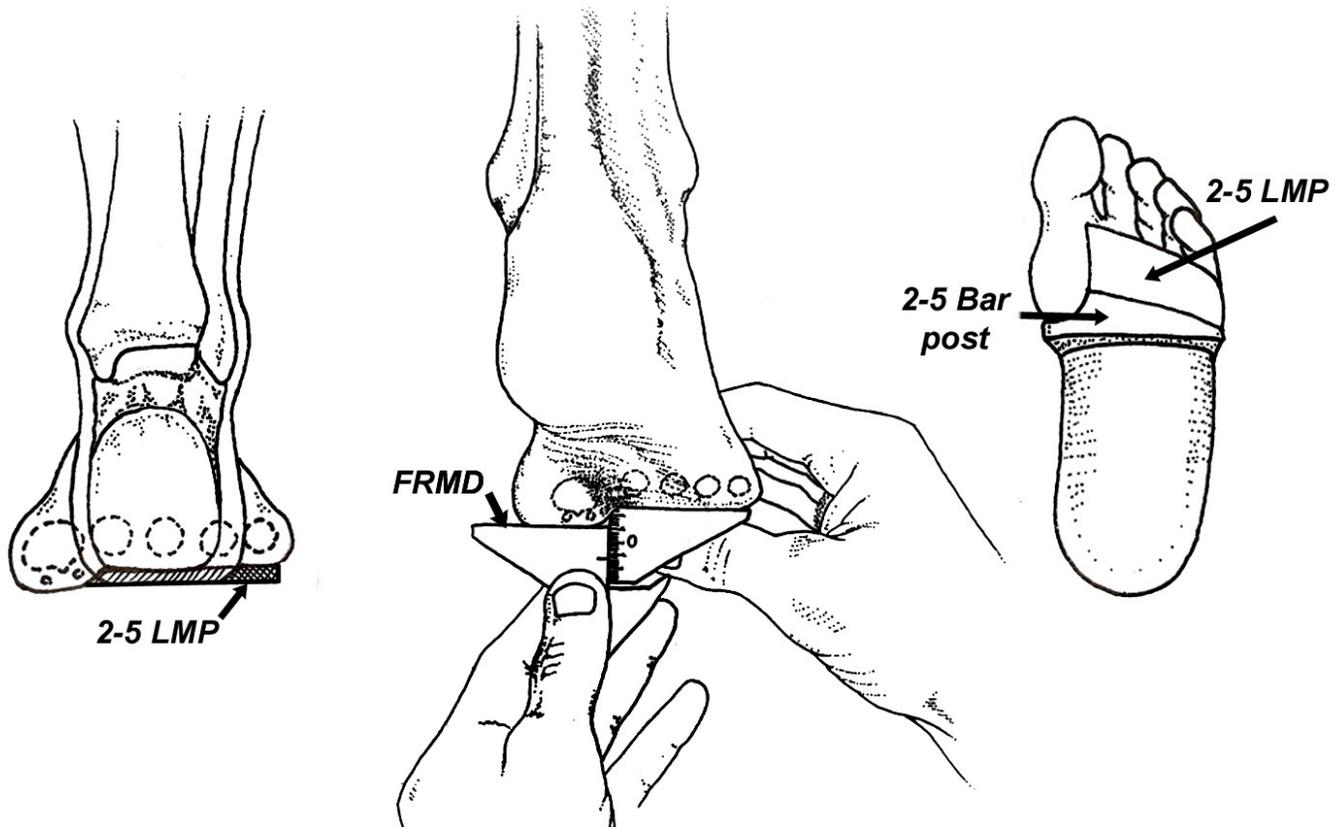


Fig. 4. Using the First Ray Measuring Device when prescribing a 2-5 bar post. A forefoot bar post (a bar post refers to an unangled forefoot post) is situated beneath the distal shafts of the second through fifth metatarsals. The portion of the bar post that would normally extend beneath the distal first metatarsal shaft is “cut-out” in order to allow the first metatarsal head to rest in its plantar position (hence the name 2-5 bar post). The thickness of the bar post is determined by the distance between the first metatarsal head and the common transverse plane of the lesser metatarsals, which may be measured with a First Ray Measuring Device. To allow for proper shoe fit, the 2-5 bar post rarely exceeds 8 mm and the area beneath the first metatarsal head is often padded with foam (e.g., PPT).