Relationship between static mobility of the first ray and segmental foot motion during the stance phase of gait

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Purpose: Examine the relationship between the static measure of first ray mobility and dynamic movement of the first ray, midfoot and hindfoot during stance phase of walking. ***Subjects:*** Six males and 9 females (mean age 28.9 years) with static first ray measures ranging between stiff and lax. ***Methods:*** Static first ray mobility was measured using a load cell device. The Optotrak motion analysis system recorded dynamic measures of first ray, midfoot, and hindfoot segmental movement while subjects walked at 3 mph. A concealed force plate recorded the beginning and end of stance. Thirteen bony landmarks were digitized to establish an anatomical reference system for the Optotrak. ***Data Analysis:*** KinGait 3 software was used to process the 3-D motion recorded by the Optotrak. Intraclass correlation coefficients (ICC 2,1) were calculated to determine reliability for the static measure of first ray mobility and bony landmark digitization. The mean and standard deviation of five dynamic trials for each subject were calculated for the motions of dorsiflexion/ plantarflexion (first ray) and eversion/inversion. Peak motion, time to peak and total excursion were determined. Motion was expressed relative to the next proximal segment. Pearson correlation coefficients were calculated to determine the association between the static and dynamic measures. ***Results:*** ICC reliability for the static measure of first ray mobility was .96 and .99 for the digitization of bony landmarks. Static first ray dorsal mobility ranged between 3.1 and 8.0 mm. Significance ($p<.05$) was found between the static dorsal first ray measure and midfoot peak eversion ($r=.59$) and excursion ($r=.61$) as well as hindfoot time-to-peak eversion ($r=.72$) and eversion excursion ($r=.73$). There was no significance between the static measure of first ray mobility and the dynamic movement of the first ray. ***Conclusion:*** Dorsal mobility of the first ray was associated with increased frontal plane motion in the midfoot and hindfoot. Increased laxity of the first ray was also associated with a delay in reaching peak hindfoot eversion, yet dynamic factors appeared to regulate the lax first ray segment under dynamic conditions. ***Relevance:*** Clinicians need to consider dynamic function when interpreting static measures of the foot. ***Key Words:*** first ray, foot, gait