The effect of angle of gait on forefoot and rearfoot radiographic parameters

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Statement of Purpose and Literature Review

Weight-bearing plain film radiographs represent a universal diagnostic assessment tool performed by foot and ankle surgeons for pre-operative planning. It is well-known, however, that these are static two-dimensional images meant to represent dynamic and three-dimensional pathology. Even though standard definitions dictate that images are taken in the angle and base of gait, we are unaware of any investigation that has specifically sought to evaluate the effect of this on radiographic interpretation [1-4]. **Therefore, the objective of this investigation was to evaluate the effect of angle of gait on the measurement of common forefoot and rearfoot radiographic parameters.**

Methodology

A series of participants without a history of foot/ankle surgery undergoing standard radiographic evaluation (including at least a WB dorsal-plantar and lateral projection) as part of their outpatient visit were specifically and quantitatively assessed for their angle of gait (i.e. the transverse plane abduction of the foot relative to the midline of the body during gait). This was quantitatively measured immediately prior to taking the radiographs (Figure 1). Measurements were then graphically depicted on a frequency scatter plot against common radiographic parameters with calculation of a Pearson's correlation coefficient.

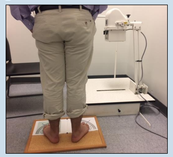
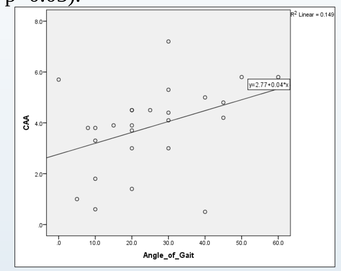
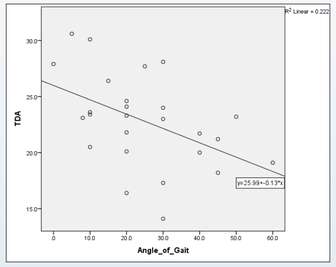


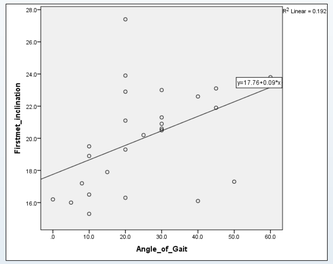
Figure 1: This investigation sought to correlate angle of gait with common radiographic parameters. Prior to taking the radiographs, an objective measure of the patient's angle of gait was calculated as pictured.

Results

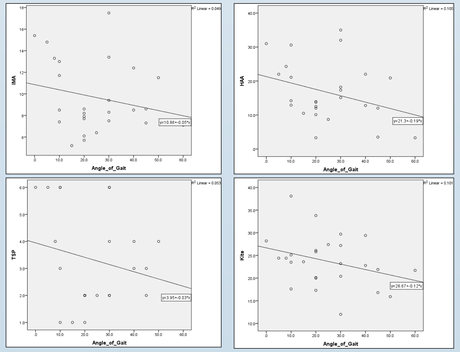
Results are displayed in the following tables. Statistically significant "moderate" correlations were observed between the angle of gait and the cuboid abduction angle (CAA; Pearson correlation coefficient 0.386; p=0.05), talar declination angle (TDA; Pearson correlation coefficient -0.471; p=0.02) and the first metatarsal inclination angle (Firstmet_inclin; Pearson correlation coefficient 0.438; p=0.03).



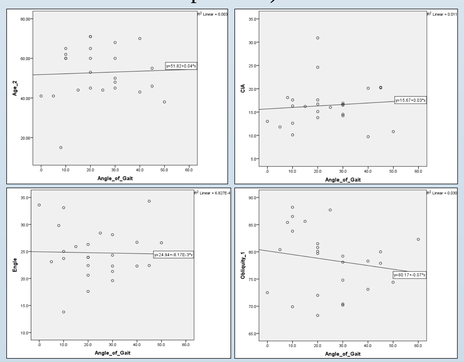




Possible weak trends were observed with the first intermetatarsal angle (IMA; Pearson correlation coefficient -0.220; p=0.280), hallux abductus angle (HAA; Pearson correlation coefficient -0.324; p=0.107), the metatarsal sesamoid position (MSP; Pearson correlation coefficient -0.229; p=0.270), and Kite's angle (Pearson correlation coefficient -0.318; p=0.113).



We observed no appreciable correlation with subject age (Pearson correlation coefficient 0.050; p=0.807), the calcaneal inclination angle (Pearson correlation coefficient 0.107; p=0.603), Engel's angle (Pearson correlation coefficient -0.026; p=0.899), and the obliquity of the first metatarsal-medial cuneiform articulation (Pearson -0.174; p=0.396).



Discussion

As with any scientific investigation, critical readers are encouraged to review the study design and results and reach their own conclusions, while the following represents our conclusions based on the specific results. As scientists, we also never consider data to be definitive, but do think that these results are worthy of attention and future investigation.

-First, the results of this investigation might help to bridge the gap between static radiographic assessment and dynamic function in foot and ankle surgery, as well as provide unique data on the developmental morphology of foot pathology.

-As would be expected, the cuboid abduction angle tended to increase as angle of gait increased (CAA; Pearson correlation coefficient 0.386; p=0.05). This finding is likely to provide a degree of validity to our preliminary data set. However, perhaps counter-intuitively, the talar declination angle tended to decrease (Pearson correlation coefficient -0.471; p=0.02) and the first metatarsal inclination angle tended to increase (Pearson correlation coefficient 0.438; p=0.03) with increasing angle of gait. This might represent a compensatory reaction between the lateral and medial columns.

-No substantial correlations were observed between transverse plane measurements of the first ray and angle of gait. We had originally hypothesized that we might observe some compensatory first ray medial deviation with increasing angle of gait.

We hope that the results of this investigation add to the body of knowledge with respect to static radiographic assessment and dynamic foot function.

References

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