



Mathematics in Surveying Foot Posture and its Effects on the Human Body

Alice S. Liu

Practical Applications of Advanced Mathematics
Mrs. Amy Goodrum and Mrs. Anna Hunt

Summer Ventures in Science and Mathematics
The University of North Carolina at Charlotte

Abstract

If you are reading this in the afternoon, then you most likely have already put a minimum cumulative weight of 700,000 pounds onto your feet - that's more than the total weight of New Jersey's annual lobster catch! The majority of the population underappreciated something as important as your pedal apparatuses, so it was investigated just how involved the feet are in the human body.

To test that, the researcher used angles and distances to determine foot posture, which was determined by four parameters: foot pronation (how much the foot rolls medially), foot progression, and arch height. Changes in sitting and standing arch height was used to indicate pronation severity, the angle formed by the midfoot line and the progression line was used to find foot progression, and the arch height index was used to determine whether subjects had high, medium, or low arch. Then, spinal curvature and patella movement was measured to determine the effects of foot posture on superior body structures.

As expected, there was a fairly strong association between arch height and pronation, and pronation and patella rotation ($r = -0.54$). This supported the hypothesis that the foot's posture affected the leg – the more inward the feet rolled, the more the leg rotated. There was also a fair association between patella rotation and spinal curvature ($r = 0.35$). However, the strongest association was observed between foot pronation and spinal curvature among subjects who complained of back pain ($r = -0.77$). This supporting evidence suggests that the feet's alignment indeed affects superior body structures.