Base of Gait is Associated with Injury among Female Collegiate Cross Country Runners
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Base of gait (BOG) is defined as the mediolateral distance between the foot and body’s line of gravity during running. It has been hypothesized that a decrease in BOG (crossover) increases risk of injury, particularly iliotibial band syndrome and tibial stress injuries. However little is known about the influence of BOG on injury status. The purpose of this study is to determine associations between BOG and running-related injury status of male and female collegiate cross-country runners.

**Number of Subjects:** Healthy NCAA Division 1 cross country runners (n=19 females, n=22 males) participated.

**Methods:** Prior to start of the 2015 competitive season, whole body kinematics were recorded during treadmill running at a self-selected preferred speed and 4.47 m/s. BOG was calculated as the mediolateral distance between a heel marker and the body’s center of mass, with negative values indicating crossover. Runners were prospectively followed during the season to monitor injuries. An injury was defined as musculoskeletal pain in the lower extremity resulting in restriction or stoppage of running for at least one or more days, and all were confirmed by the team’s sports medicine personnel. Independent t-tests were used to compare BOG at each speed between those that did and did not sustain an injury. Males and females were analyzed separately as BOG has been shown to be greater in females.

**Results:** Over the course of the season, 8 female and 12 male runners sustained a lower extremity running-related injury. Female runners that were injured during the competitive season displayed a more narrow BOG at pre-season while running at their preferred speed (3.8 ± 0.2 m/s) than their teammates who remained healthy (injured: 1.0 ± 1.0 cm, healthy: 1.9 ± 1.8 cm, p=0.038). This relationship also held true at 4.47 m/s (injured: 0.4 ± 1.1 cm, healthy: 1.6 ± 2.0 cm, p=0.033). No significant relationship between BOG and injury status was observed in male collegiate runners at preferred speed (injured: -1.3 ± 1.9 cm, healthy: 0.41 ± 1.6 cm, p=0.458) or 4.47 m/s (injured: -1.8± 2.1 cm, healthy: 0.05 ± 1.5 cm, p=0.283).

**Conclusion:** Female collegiate cross country runners that sustained a lower extremity musculoskeletal injury during the competitive season displayed a more narrow BOG than those that remained healthy. The decreased BOG was observed at the runners’ preferred speed and a more intense speed of 4.47 m/s (6:00 min/mile pace). This relationship between injury and BOG was not present among the male collegiate cross country runners.

**Clinical Relevance:** Our findings support the speculation that running with a narrower BOG is associated with sustaining a lower extremity running-related injury. However, this was observed among females only, which may be due in part to females having a wider BOG than males. Increasing BOG in female collegiate cross country runners that display narrow BOG may be beneficial in the prevention and treatment of running-related injuries.