Effect of Foot Type and Landing Height on Acceleration Values of the Lower Leg
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Context: Tibial overuse injuries (e.g. stress fractures, “shin splints”) are prevalent among the athletic population and may be related to shock acceleration of the shank. Foot pronation unlocks the midtarsal joint, increasing foot mobility and thus permitting rotation of the tibia and increasing the time over which shock absorption can occur within the shank. Navicular drop is one measure of the amount of pronation that occurs within an individual’s foot, and therefore may have an effect on tibial acceleration upon landing. Objective: To investigate whether a correlation exists between navicular drop measurements and tibial acceleration values recorded while landing from three different drop heights. Design: A correlational design was employed. Setting: Controlled research laboratory setting. Participants: Eleven subjects (72.2+/-28.8 kg, 171.45 +/-11.25 cm, BMI = 24.8) volunteered to participate in the study. Subjects were excluded if they suffered a lower extremity injury/ surgery within the past year or were currently experiencing lower extremity pain that would be exacerbated during the protocol. Interventions: The independent variable was the navicular drop measure. The dependant variable was the vertical tibial acceleration value. Subjects landed from three drop heights (9”, 12”, and an individual drop height (IDH) (75% of the subject’s maximum vertical leap)). A Biopac (Goleta, CA) accelerometer (TSD109 series) was placed distally (approximately 1/3 up from the medial malleolus) on the dominant tibia and secured with a tightened strap. The subjects were asked to “drop land” six times from each of the three fixed heights previously mentioned onto a Novel Pressure Platform (Munich, Germany) which marked ground contact. The acceleration values were recorded using Noraxon (Scottsdale AZ) software. Main Outcome Measures: Vertical tibial acceleration (G’s) Results: Navicular drop measures averaged 7.116 +/-2.98mm. The average IDH was 13.1+/-3.41 inches. The average shank acceleration values were 6.18+/-1.44G when landing from a 9” drop, 8.87+/-2.69G when landing from a 15” drop, and 8.77+/-2.31G when landing from the IDH. There was a significantly higher shank acceleration when landing from 15” as opposed to 9” (p=.03). r= -.201 for the navicular drop/ shank acceleration correlation (p=.553) at 9”, r= .247 for the navicular drop/ shank acceleration correlation (p=.465) at 15”, and r= -.069 for the navicular drop/ shank acceleration correlation (p=.839) at the IDH. Conclusions: Measurement of shank accelerations may help researchers to understand the etiology of overuse injuries. The higher G values when landing from a higher height were expected. There were no significant correlations between navicular drop and the shank acceleration. The foot motion alone (as indicated by navicular drop) does not appear to influence shank acceleration; frontal plane ankle motion likely also has an effect on shank accelerations. Word count: 436