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Influence of Turf Surface on Change of Direction Parameters

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(No relationships reported)

The surface over which people complete sports tasks can influence body posture and performance outcomes.
PURPOSE: This study compared time to complete a change of direction agility drill and stopping strategies during this drill on different modern sports turfs, including three different artificial turf systems (AS1,AS2, AS3) and a natural grass surface (NS).
METHODS: Six participants (ages 19-30 yrs; height = 1.79 ± 0.08 m; mass = 75.9 ± 10.1 kg) were recruited and provided voluntary consent. Each participant performed three trials of a 5-10-5 agility drill on each of the four surfaces, as quickly as possible. A Fitlight® timing tool was used to collect the performance measure of time to complete the task. The segment positions were collected using the Xsens MVN Awinda inertial motion capture system and the variable of angle between sacrum, heel and ground (SHAng) was determined through Visual3D for the plant leg.
RESULTS: The data from three trials for each participant, for each surface, was included in the statistical analysis. The repeated measures ANOVA for each variable yielded significant differences between surfaces. Pairwise comparisons indicated that change of direction time on AS1 (4.70 ± 0.14 s) was significantly less than on AS3 (4.83 ± 0.28 s; p=.007) and NS (4.83 ± 0.30 s; p=.0014). In addition, SHAng 5 on NS (39.0 ± 4.7 deg) was significantly larger than on all artificial surfaces (AS1: 35.1 ± 3.8 deg, p=.014; AS2: 34.9 ± 2.5 deg, p=.002; AS3: 35.4 ± 3.6 deg, p=.019). Last, SHAng 10 on NS (38.5 ± 4.5 deg) was significantly larger than on all artificial surfaces (AS1: 35.7 ± 2.9 deg, p=.024; AS2: 35.7 ± 2.4 deg, p=.022; AS3: 36.1 ± 2.5 deg, p=.028).
CONCLUSION: This project indicates that these participants adopted a different stopping strategy on the natural surface than the artificial surfaces. To mitigate the lower resistance to shear forces offered by natural grass, the participants adopted a more upright body position, presumably increasing the normal force as well as the friction utilized at the foot-to-ground interface. Assuming adequate friction is maintained, a smaller SHAng and thus lower body position will provide for an increase in propulsive forces resulting in a faster change in direction and better performance outcome.
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Kinetic Strategies during Single-Leg Hopping in Individuals With and Without Chronic Ankle Instability

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(No relationships reported)

Adaptability of the motor system indicates successful management of chronic ankle instability (CAI). Research shows that individuals who do not exhibit residual symptoms following an ankle sprain (i.e. copers) exhibit greater adaptability during walking compared to individuals with CAI. However, questions remain surrounding systemic differences exhibited by coper groups, particularly when higher movement demands are imposed on the system. Analysis of load acceptance patterns during single-leg hopping could provide an indication of the systemic movement adaptations between the groups during higher demands of movement tasks.
PURPOSE: Examine percent contribution (%C) to support moment (MS) during single-leg hopping in healthy, coper, and CAI groups.
METHODS: 48 individuals (16 per group) participated in the study. Participants performed 15 trials of single-leg hopping. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of the ankle (A), knee (K), and (H) moments in the sagittal plane. The %C of the A, K, and H moment to MS was calculated at 15 percent of stance phase. A one-way ANOVA was conducted to assess group effects for each dependent measure.
RESULTS: No significant differences in %C to MS were found between the healthy (A 81.87±18.37%, K 23.81±16.96%, H 2.22±27.19%), coper (A 73.78±23.33%, K 28.28±21.05%, H -6.51±33.17%), and CAI groups (A 83.76±17.91%, K 16.48±12.58%, H 0.78±19.71%) during the initial loading phase of single-leg hopping.
CONCLUSIONS: Copers did not exhibit distinct kinetic patterns during single-leg hopping. This finding suggests that adaptation of movement is less likely to occur with higher demands of movement tasks following ankle injury. It is also possible that low amplitude COM displacement associated with the hopping task may not have placed adequate constraint on the subjects to elicit adaptive strategies. More research is needed to explore how individual joint kinetic adaptations contribute to dynamic tasks across groups.

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Biomechanics of Pitching: Horizontal Abduction Predicts Power; Power Predicts Strikeouts and Wins

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(No relationships reported)

Traditional strength training for pitchers focuses on compound lifts, predominantly of the lower extremity, to increase pitching power. Though widely employed, this approach has not been sufficiently validated.
PURPOSE: To evaluate both predictors and consequences of increased mechanical power in collegiate pitching.
METHODS: 10 pitchers from a D1 baseball program underwent 4 days of assessment separated by at least 3 days of rest: 1) Squat max was performed and recorded, 2) Sparta force plate (Sparta Science, USA) captured load, explode, and drive. 3) Proteus (Boston Biomotion, USA) measured power and endurance in 10 movements: Left and right core rotation, internal and external rotation, shoulder flexion and extension, elbow flexion and extension, and horizontal adduction and abduction. 4) Proteus recorded throwing mechanics via 5 sets of pitches (4 reps per set) at varying loads of magnetic resistance, ranging from 1-5lbs. For all movements, Proteus calculated and exported power and endurance in 3D space. Linear regressions identified predictors of pitching power and the effect of power on pitching performance. Owing to the small sample and novel technology, trends (p<0.08) were considered.
RESULTS: Mean pitching endurance did not significantly predict strikeouts or wins. Mean pitching power predicted greater win percentage (R=0.734; p=0.024), total strikeouts (R=0.662; p=0.052), and strikeouts per game (R=0.656; p=0.055). No associations were found between Sparta data or squat max and win percentage or strikeouts. Pitching power had no relationship with Sparta data, squat max, height, weight, class year, or arm length. The strongest predictors of pitching power were horizontal abduction endurance in the dominant arm (R=0.941; p=0.002) and non-dominant arm (R=0.934; p=0.002). Strikeouts per game was related to win percentage (R=0.680; p=0.044).
CONCLUSION: Power was the most important predictor of on-field pitching performance. It was unrelated to anthropometric variables and showed no association with minor differences in maturation (e.g., freshman to sophomore). There was also no association with force plate and squat performance. These preliminary data suggest training horizontal shoulder abduction may correspond to power; in turn, power appears to increase strikeouts and win percentage.