PURPOSE: 1) to examine the effect of suspension training on functional movement, assessed via the FMS and MAPS and 2) to identify the correlation between the FMS and MAPS.
METHODS: Twenty-seven participants (19 females; 8 males; Age = 26.0 ± 11.1 yrs; Height = 167.9 ± 9.1 cm; Body Mass = 69.6 ± 14.1 kg) completed 28 exercise sessions over a 14-week course. Throughout each 40-minute exercise session, six body positions were utilized on the suspension training straps which included push, pull, rotational, squat, and lunge movements; participants also engaged in functional training utilizing stability balls and resistance bands. Pre- and post-fitness assessments included the FMS, MAPS, body composition, muscular endurance, muscular strength, and flexibility. Dependent t-tests were used to determine if there were mean changes in functional movement status. Due to multiple comparisons, Bonferroni correction was used, therefore, alpha level was set at .007.
RESULTS: There were significant positive changes in FMS (14.6 ± 2.7 to 15.9 ± 2.1, p<0.001) and MAPS (52.9 ± 10.3 to 56.3 ± 9.7, p<0.001) values, as well as mean quantity of push-ups (24.9 ± 11.5 to 29.4 ± 13.9, p=0.004) and handgrip dynamometer (78.0 ± 21.7 kg to 85.6 ± 24.0 kg, p= 0.006). There were no significant changes in mean body mass, fat mass, lean mass, percent body fat, and sit-and-reach values. Pearson correlation was used to determine the relationship between FMS and MAPS both at pre- and post-testing. At both time points, pre- and post-testing, the correlations were significant (r = .52 and .43, respectively).
CONCLUSIONS: Participation in suspension training produced significant improvements in overall functional movement, muscular strength, and endurance. Although there were significant positive changes in both FMS and MAPS from pre- to post-assessment, a weak correlation existed between the FMS and MAPS assessments.

3509 Board #197 June 1 8:00 AM - 9:30 AM

Biomechanical Analysis of Collegiate Baseball: Training Implications for Enhancement of Pitching Endurance

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(No relationships reported)

Endurance is critical to a starting pitcher's success. However, the repetition of pitching stress can decrease performance and increase risk of injury in later innings. Improving arm endurance likely enhances late-game performance.
PURPOSE: To evaluate predictors of mechanical endurance in collegiate pitchers.
METHODS: 10 Division-1 pitchers were tested using Proteus technology (Boston Biomotion, Inc.). They completed 6 sets of 5 pitches; each set changed in resistance, ranging from ½ to 5 lbs. Endurance was a calculation of the ability to preserve power in each set on a continuous scale of 0.00 (0% preservation) to 1.00 (100% preservation). Mean endurance was the mean value of all 6 sets. Proteus also assessed biceps curls, triceps extensions, internal and external rotation, and horizontal adduction and abduction. Pitchers were tested during the 2017 season and data were compared to in-game performances. Linear regressions tested the relationships between endurance, performance on other tests, and in-game statistics.
RESULTS: Pitchers were 72.0 ± 2.7 inches in height, had a mean fastball velocity of 84.6 ± 3.9 mph, a mean earned run average (ERA) of 5.8 ± 2.8, and a mean endurance of 97.7 ± 1.9%. Endurance was unrelated to class year (p=0.857) and was not related to anthropometric measurements, including height (p=0.460), weight (p=0.188), arm length (p=0.350), and leg length (p=0.464). Maximum squat strength (p=0.917), fastball velocity (p=0.832), and three-dimensional measurement of pitch range of motion (p=0.730) were also unrelated to pitch endurance. Biceps curl endurance (p=0.035) and triceps extension explosiveness (p=0.089) of the dominant arm correlated with pitching endurance. These relationships lost significance on non-dominant arm for curls (p=0.241) and extensions (p=0.187). Given a larger sample, other associations may be found; of interest, there may be relationships between endurance and innings per appearance (β= 0.353, R^2=0.196; p=0.232) and ERA (β= -0.559, R^2=0.149; p=0.305). Post-hoc power analyses revealed samples of 30 and 38 respectively to reach significance (power=0.80; p=0.05).
CONCLUSIONS: Fatigue results from repetitive overhead throwing, elevating risk of overuse injuries. Use of Proteus may provide modes of exercise unrecognized by traditional baseball training.

3510 Board #198 June 1 8:00 AM - 9:30 AM

Automated Impact Corroboration From Game Video In Ice-hockey Using Computer Vision Approaches

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PURPOSE: Video corroboration of on ice impacts identified by wearable sensors (WS) is a time-consuming task. To automate this, we attempted a computer vision approach to recorded game video to corroborate impacts identified using WS among national ice-hockey team members.
METHODS: 23 U.S. National U18 Hockey team members consented to procedures approved by EMU HSRC. Impacts were previously validated from data collected at 100 Hz (Impact Processor, Zephyr MD) from 8 players with the top activity levels determined by WS in 4 games. Game video was manually synchronized, and timestamps were used to extract frames from the video that allowed for visually identifying and labeling impacts. A convolutional neural network (YOLO) was used to detect impacts in video and generate a training dataset from 1060 images from 3 game videos that included 86 impacts.
Video and timestamps were used for training instead of still frames. Denoising filters were used to account for time shift errors due to manual labeling and anomalous detections appearing and disappearing in up to half a second of video. Thus, we removed any impacts detected by video for less than 30 or 60 continuous frames (0.5 or 1.0 second, respectively). An smaller version of the model (YOLO-tiny) was also tested on a Note 8 (Samsung) smart phone to determine applicability to real-time game setting.
RESULTS: The trained YOLO network was applied to the 4th game video that had 32 validated sensor identified impacts. The model successfully detected all 32 impacts but generated 1000 false positives. With a 60 frame filter, the model detected 20 of the 32 events, but false positives were reduced to 211. With a 30 frame filter, the model detected all 32 impacts but false positives increased to 391. Interestingly, the mobile model and 30 frame filter detected all 32 impacts with 222 false positives, of which, 99 were classified as "Pass Bys" or players that occluded each other on the video but did not make physical contact.
CONCLUSION: These results demonstrate that computer vision techniques can be used to identify validated impacts with high success, but with many false positives. The high false positive rate presents a challenge, but since a large proportion of false positives were simple pass-bys, using a real-time sensor fusion approach with WS, the false positives may be reduced substantially.

3511 Board #199 June 1 8:00 AM - 9:30 AM

Relationship Between the Perceived Training Loads of Division II Swimmers and Coaches

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(No relationships reported)

Monitoring training loads provides coaches the opportunity to create effective programs for their athletes to prepare for competition and make adjustments to manage fatigue, reduce the risk of soft-tissue injuries and non-functional overreaching. An athlete's training load is a combination of the external load (work completed by the athlete) and internal load (physiological or