28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Accelerometery vs. video-derived stroke parameters in high-level swimmers

Musson, C.

Nelson Mandela University

INTRODUCTION:
Swimming is a multifaceted sport with nuanced performance parameters that tend to vary according to the swimmer's stroke style [1]. The extraction and analyses of swim parameters, such as lap time (LT), stroke length (SL), stroke rate (SR) and velocity are time-consuming [2]. This may be eased, and to some extent automated, by the use of cost-effective tri-axial accelerometers.
OBJECTIVES:
To determine the validity of tri-axial accelerometers across all four stroke styles, and to investigate kinematic differences in stroke styles using accelerometer-based data.
METHODS:
Twelve elite swimmers were recruited for the study. The group consisted of five male (age: 22.2 ± 2.6 years; height: 1.84 ± 0.08 m; weight: 76.2 ± 3.6 kg) and seven female (age: 20.7 ± 2.1 years; height: 1.68 ± 0.08 cm; weight: 62.0 ± 6.3 kg) swimmers. A 4 x 50-m individual medley was completed in a 25-m pool, with tri-axial accelerometers fitted to the swimmer's left wrist and upper-back, sampling at 100Hz. Accelerometer data (reference method) were compared to high-speed video (criterion method) to evaluate the validity of the key stroke parameters.
RESULTS:
There was a small but significant bias for accelerometery data compared to video data for most parameters evident from the mean bias differences across all stroke styles for swimming velocity (Mdiff = -0.05m/s, $p<0.019$), SR (Mdiff = -0.02str/sec, $p<0.047$, except freestyle, Mdiff = -0.01str/sec, $p = 0.083$) and lap time (Mdiff = 1.38 sec, $p<0.001$). No statistical differences were evident for SL (Mdiff = 0.01m/str, $p = 0.795$) and stroke count (Mdiff = 0.19, $p = 0.280$). However, the accelerometery-derived SR, SL and velocity can be considered practically useful based on the training requirements of coaches, with a two one-sided t-test indicating that these parameters fell well within their equivalence bounds for all strokes (velocity = ±0.10m/s, SR = ±0.04str/sec, and SL = ±0.02m/str). Parameters derived from video analysis compared to accelerometery were highly correlated ($r > 0.91$) and therefore consistent regardless of the method of analysis.
CONCLUSION:
Slight statistical differences were present between the video and accelerometer data, suggesting that the accelerometers may not be a "true" surrogate compared to video data. The accuracy of the results obtained were on par with those of other studies, even though the sample investigated were different [3,4]. Hence, the accelerometers showed potential for monitoring of swimmers in training, with the practical usefulness for coaches. Future research should investigate real-time feature extraction, effects of injury and/or fatigue, and whether training interventions yield detectable changes in stroke mechanics when using accelerometery.

REFERENCES:
[1] Hay J., Michigan: Prentice-Hall;1993
[2] Stamm A et al., Sport Eng.; 2013
[3] Mooney R et al., Sport Exerc Med Open Journal; 2015
[4] Ganzevles S et al., Sensors; 2017

Topic: **Biomechanics**

Presentation **Poster**

European Database of Sport Science (EDSS)

Supported by SporTools GmbH

34044