Comparison Between two Different Types of Instruments:
an Encoder and an Inertial Sensor Device

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INTRODUCTION

The measurement and analysis of the kinematics of the swimmer is difficult and complex due to the environment in which it occurs. The research and development of new technologies aim to give the coach the opportunity to obtain more immediate information. In this work, the performances of two different instruments, that can be used as field tools by coaches, were compared.

METHODS

The instruments used were the SpeedRT (ApLab Rome), measuring distance and time through the extraction of a wire coil placed in a rotating sensor (figure 1), and FreeSense (Sensorize Rome), measuring triaxial linear acceleration and angular velocities based on the technology system 3D MEMS (figure 3). 8 swimmers (180 ± 8.7 cm, 77 ± 9.7 kg) wore simultaneously the two devices. The Freesense has a belt with a back support, and the SpeedRT was connected to the belt. The subjects performed 3 trials of 25 m in 3 different swimming styles (crawl = T1, butterfly = T2, breaststroke = T3). The recorded signals (figure 2 and 4) were exported in spreadsheet format to identify the starting time instants, to overlap the acceleration curves and to perform the comparison.

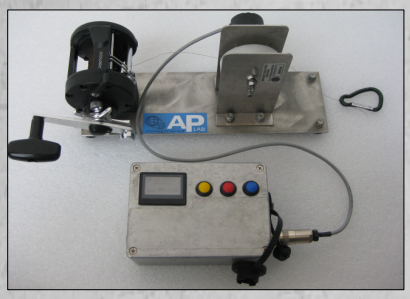

Figure 1. *The encoder used in the test*

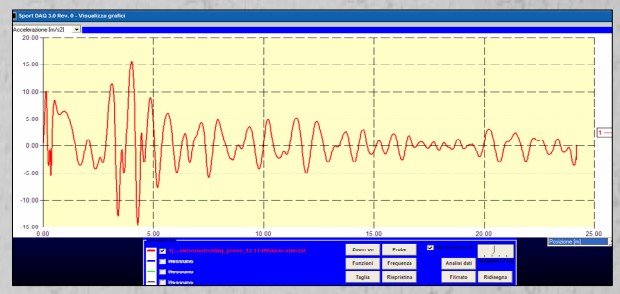

Figure 2. *An example of acceleration measured by the encoder*

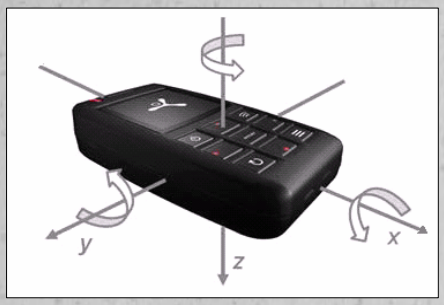

Figure 3. *The inertial sensor device used in the test*

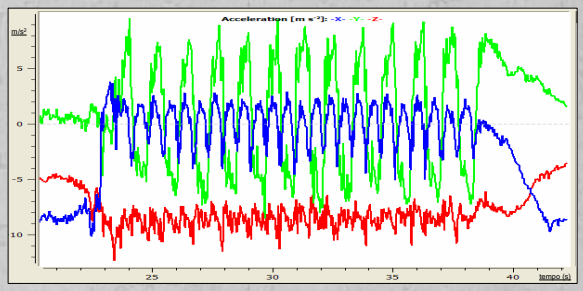

Figure 4. *An example of acceleration measured by the inertial sensor device*

RESULTS

The average correlations between the instruments was high and homogeneous: for T1 R = 0.77 ± 0.08, for T2 R = 0.88 ± 0.02, for T3 R = 0.88 ± 0.02. The difference between the average values of signals for SpeedRT vs FreeSense was -0.19 (± 0.61) m×s-2. Considering the positive acceleration this value was 0.53 (± 0.22) m×s-2,while for the negative acceleration was -0.63 (± 0.35) m×s-2.

CONCLUSION

Morouço (2006) compared data of acceleration acquired by the video system and SpeedRT. In this work, the signals showed good temporal overlapping and relationship. The average difference, in our view, reflected the specific features of the tools and their applications. For symmetric styles, characterized by higher accelerations, the signals' correlation is high, while a smaller correlation was found for the crawl. The wire accelerometer allows to get "on-line" indication of space that allows analysis of speed of movement in different phases of the trials, while the sensor accelerometer is not bound to linear measurements and considers three reference planes.

REFERENCES

Morouço P., Lima A.B., Semblano P., Fernandes D., Gonçalves P, Sousa F., Fernandes R, Barbosa T., Correia M.V., Vilas-Boas j.P., (2006) Validation of a cable speedometer for butterfly evaluation. Revista Portuguesa de Ciências do Desporto, Vol. 6, Supl. 2, 236-239