one way repeated measures ANOVA was used to compare IVV and IdC along the test. Regression equations, as well as its coefficients of determination and Pearson correlation coefficients, were computed to assess the relationships between IVV (x, y, z) and IdC. The level of statistical significance was set at $p<0.05$.
DISCUSSION & CONCLUSION The analysis of IVV throughout the 200m front crawl effort revealed a non-significant difference between laps in the three axes of motion and significant differences for the IdC between each 50m length. These results are in accordance with previous (unpublished) data from our group. The main finding of this study was non-correlation between IVV and IdC for the three axes, suggesting that the stability of the IVV was ensured by changes in the arm coordination. The high inter-variability of IdC suggests future studies with larger samples.
KEY WORDS Intracyclic velocity variation, arm coordination, swimming

Tethered swimming in crawl: Arm stroke propulsive force at different 5 swim rates

L. Leitão [3], I. Karsai [2], H. Louro[1], N. Garrido [3], A. Conceição [1] and A. Silva [3]
[1] Sports Sciences Research Laboratory, Sport School of Rio Maior, Polytechnic Institute of Santarém, Portugal, [2] University of Pécs, Institute of PE and Sport Sciences, Pécs, Hungary, [3] University of Trás-os-Montes and Alto Douro, Vila Real, Portugal

OBJECTIVE A swimmer's performance results from the interaction of propulsive and resistive forces, which can only increase by reducing the resistive forces, or increase the propulsives forces (Toussaint, 2006). Researchers have developed many methods for this type of evaluation, tethered swim (Dopsaj et al., 2003, Taylor et al., 2001) and Mad-System (Toussaint, 2006).
METHODS Six males swimmers of the portuguese national team(21.8+.9yrs,73.64+6.9 bm,182.26+6.1bh) performed only the arm crawl swimming task, on an ergometer without breathing, with tied and supported legs, and with the head placed in a helmet containing a sensor of force, connected to a computer. The frequency increment was set at 5 cycle/min(C/M) from 35C/M to 55C/M. Four underwater cameras were used to kinematical analysis with APAS. Descriptive statistics were used, and Pearson correlation to identify the correlation between the increase of the propulsive force and swim rate, with a level of significance of $p <0.05$.
RESULTS The swimmers reaches a high value of propulsive force in the entry of the arm due to join the insweep and upsweep action of the other arm. The 45 C\\M is the rate that reach a higher propulsive force, while the insweep action on the 55 C\\M rate is where the swimmers reach the maximum propulsive force. The correlation between the increase in strength and the swim rate was significant ($r = 0.754$, $p <0.05$).
DISCUSSION & CONCLUSION The most effective swim rate is the 45C\\M which the swimmer can develop greater propulsive force (128.01 N) whether or not the fastest swim rate analyzed, and the insweep action is the most propulsive on all stroke phases.
KEY WORDS Tethered Swim; Propulsive Force; Crawl; Swimming Biomechanics

Handgrip is associated with swimming performance in female elite swimmers but not in male

Aldo M Costa [1], Daniel A Marinho [1], Hugo Louro [2], António J Silva [3], Vito M Reis [3], Albano Santos [1], Mário C. Marques [1]
[1] Department of Sports Sciences, University of Beira interior, Covilhã, Portugal, CIDESD, [2] Sports Science Institute of Rio Maior. Rio Maior, Portugal, CIDESD, [3] University of Trás-os-Montes and Alto Douro, Department of Sport Sciences. Vila Real, Portugal, CIDESD

OBJECTIVE Several authors have been trying to isolate, from a wide range of variables, those which determine mostly the success in competition. The hand grip isometric strength, long used as a measure of total body strength was, recently, associated with swimming performance in young and elite master swimmers. In this context, the aim of this study was to associate the hand grip isometric strength with swimming performance in male and female elite swimmers.
METHODS 35 elite Portuguese swimmers from both genders were selected (19 males and 16 females, 18.8 ± 3.2 years). For each subject the grip strength in both hands was measure using an adjustable mechanical hand dynamometer. The best performance in 100, 200 and 400 meters front crawl were used as dependent variables.
RESULTS Our results show, in females, a relationship between right grip strength and swimming performance in 100 meters front crawl ($r=-0.562$, $p=0.029$). There was no relationship between swimming performance in longer distance competitive events (200 or 400 meters) or among males ($p>0.05$).
DISCUSSION & CONCLUSION Despite the general type of this strength assessment, grip strength seems to be a good and stable estimator of swimming performance in short distance events, namely in elite female swimmers.
KEY WORDS Swimming, handgrip, genders