Relationship between the developed force and strokes frequency in all-out 30 seconds tethered test applied to canoe slalom.

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Abstract
The aim of this study was to verify whether the force development and maintenance in the all-out 30 seconds tethered test are related with the number of strokes performed by slalom kayakers during this specific test. Thirteen male slalom kayakers of the Brazilian National Team were undergone a maximal all-out tethered test, conducted in the pool and on kayak. Through this protocol was possible to determine the peak, mean, minimum force and the fatigue index. Aiming to quantify the number of strokes, all tests were filmed and analyzed integrally (30 s) and detailed in frames 5 s. The mainly results showed that the highest peak and mean forces for each frame 5 s occurred in different moment in which the highest number of strokes occurred. Thus, the study suggests the occurrence of a higher force development in a specific frame seems not to solely depend on the paddle strokes performed during the same frame. Nonetheless, the strokes performed throughout the test were effective to maintain the force, suggesting that the performed strokes are effective to its purposes.

Key words: Canoe Slalom, All-out, Analysis of Video.

Introduction
The tethered ergometer can be considered an attractive and valuable tool because it allows the analysis of force preserving the specific movement. In the literature, the importance of applying tethered tests in several sports can be viewed. Regarding the canoe slalom, it is not observed studies aiming the analysis of specific stroke movement and their respective influence in the force development in an tethered all-out 30s test. Thus, the objective of this research was to investigate whether the force production and maintenance are related to the number of strokes performed by the slalom paddlers during an tethered all-out 30s test.

Results and Discussion
Thirteen male slalom kayakers of the Brazilian National Team (18 ± 1 year), were evaluated. The protocol consisted of maximum tethered effort during 30s on kayak in pool. A load cell system was used as the primary sensor, allowing the force development analysis (peak, mean, minimum strength and the fatigue index) during the test. All tests were filmed and analyzed aiming analysis of the number of strokes performed during the same moment. The principal results of this study showed that the higher peak and mean force for each 5s frame occurred in different moment in which the highest number of strokes occurred (frame 2, 154.1 N, P<0.001; frame 1, 94 strokes, P<0.001, respectively). Thus, it is possible to suggest that the ergometer characteristics used in the evaluations contributed to the delayed achievement of higher force values occurrence. However, no difference was visualized between the frame 3, frame 4, frame 5 and frame 6. Supporting the above-mentioned results, the total number of strokes was significantly correlated with the absolute mean force (r=0.68), suggesting the strokes performed during the test was effective for maintaining strength over the same.

Conclusions
We conclude that the number of strokes is not directly related to the achievement of peak and mean force values for each 5 s in an tethered all-out 30s test. On the other hand, the total number of strokes performed by the kayakers was effective to maintain this force throughout the test, suggesting the frequency of strokes appears to be related to the strength maintenance in tethered all-out 30s test.

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