DOES STRAPPING THE ROWER TO THE SEAT ENHANCE ROWING PERFORMANCE?

A.J. "Knoek" van Soest, J. van Zeil and T. Guhr
Faculty of Human Movement Sciences and IFKB, Free University Amsterdam, the Netherlands
email: k.vansoest@fbw.vu.nl

INTRODUCTION

A well-known coordination problem in rowing is to prevent "shooting the slide"; rowers must prevent lifting themself from the sliding seat, which may occur when pulling too hard on the oar handle. We have three indications that this constraint may limit performance. First, novice rowers are known to shoot the slide quite often. Second, the vertical seat reaction force in expert rowers approaches zero during the pull phase [1]. Third, a simulation study indicated that eliminating the no-slide-shooting constraint on coordination by "strapping the model to the sliding seat" may increase performance during the first stroke [2]. Thus, in this experimental study we address the question if rowing performance can be improved in well-trained rowers by strapping them to their sliding seat. As the mechanics of ergometer rowing have been shown to be comparable to on-water rowing, this question is addressed in the context of ergometer rowing.

METHODS

Six well trained rowers participated in two ergometer rowing tasks, using an instrumented Concept IIC rowing ergometer. The first task, mimicking the start of a race, was to perform a series of two maximal strokes, starting from zero flywheel velocity. The second task, mimicking high-intensity steady state rowing, was to was to row 500 meters, where the first and last 150 meters (approximately 15 strokes each) were performed at maximal intensity. Both tasks were performed three times, both under normal conditions and while strapped to the sliding seat. Apart from a warming up period of 20 minutes, the participants had no training with the strap. The rowing ergometer was instrumented with 6-channel AMTI force transducers under the feet and under the sliding seat; a one-channel force transducer was mounted between the handle and the chain. An Optotrak system was used to measure kinematics. From these data, mechanical work and average mechanical power delivered by the rower to the ergometer during the stroke phase were calculated. Data were analyzed using paired Student's *t*-tests and ANOVA ($p=0.05$).

RESULTS AND DISCUSSION

Results for the first two strokes after the start are summarized in Table 1. The significant difference in min(F_seat_z), the minimum of the vertical force under the seat, indicates that subjects used the strap. This resulted in a higher peak handle force, which in turn resulted in higher stroke work and higher average power output during the stroke. Together, these results indicate that in this task, removing the no-slide-shooting-constraint on coordination by strapping the rower to the sliding seat allows rowers to pull harder at the handle and thus to perform better.

Results for the the high-intensity steady state rowing task investigated were less clear. While min(F_seat_z) was significantly lower when strapped, and rowers thus appear to use the strap, this did not result in a significantly higher average power output in a group analysis (data not shown). However, ANOVA's on the individual subjects indicated that in 3 out of 6 subjects, average power output was significantly higher in the strapped condition, with relative differences between 2.0% and 3.7%.

One possible explanation of the results is that during high-intensity steady state rowing (as opposed to short-duration sprinting), physiological limitations on power output are such that the no-slide-shooting constraint is "inactive". This would imply that during steady state rowing, removing this constraint by strapping the rower to the sliding seat is ineffective. Another possibility, that will be addressed in a future study, is that subjects need to learn to exploit the strap during steady state rowing.

Table 1. Results for strokes 1 and 2; * indicates significance

	Stroke number	Normal	Strapped	Rel. diff. (%)	
Min(F_seat_z) (N)	1	54	-5	-108.9	*
	2	27	-15	-155.5	*
Max(F_handle) (N)	1	1114	1177	5.6	*
	2	1091	1163	6.6	*
Max(v_handle) (m/s)	1	1.69	1.80	6.4	
	2	2.17	2.23	2.7	*
Work (J)	1	977	1020	5.2	
	2	940	990	5.4	*
Average power (W)	1	768	839	9.2	*
	2	1474	1574	6.8	*

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REFERENCES

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2. Soest AJ van, et al. *Proc. of VIII TGCS Symposium*, Milan, Italy, 105-108, 2001.

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