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OPTIMIZING OAR-SHAFT STIFFNESS IN ROWING

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SUMMARY

INTRODUCTION

Quantifiable oar-shaft deformation can be detected using merely the naked eye during rowing competitions. Previous research [5] likewise showed a significant difference in rotational rates between the blade and oar-lock during the drive phase. In theory, the force (N or kg x m/s2) applied at the oar handle is fully transmitted down the oar-shaft, through the blade, and into the water. This simplification is similar to the perfect efficiency in transferring power (ω or J/s) from the rower to the water. Oar manufacturers, such as Concept2^{TM} (Figure 1), categorize oar-shaft stiffness by measuring the amount of bending under a 10kg (98 N) load applied at 2.05m from the gate [4]. However, a universally recognized optimal oar-shaft stiffness level does not exist. Some researchers suggest rowing with a less stiff oar-shaft [3] while others advocate stiffer levels [1]. Therefore, the aim of the following study is to examine the relationship between experience level and oar-shaft stiffness via on water rowing performance.

METHODS

Eight (n=8) sculling rowers, four novice freshmen and four elite varsity, will be recruited from the University of Western Ontario Rowing Club. Data will be collected from the impeller, a high grade boat sensor (Peach Innovations Ltd., United Kingdom) and a replacement oarlock with strain-gauge force transducers (Peach Innovations Ltd). All oars will be manufactured by Concept2^{TM}. The two oars being tested will be similar in every way except in stiffness level (Table1). Similar to previous on-water studies [2], participants will row 500m at their race pace with each oar.

RESULTS AND DISCUSSION

The following are expected results: Independent of rowing caliber, the effects of oar-shaft stiffness may be negligible given the continuous resistance provided by the water in addition to the low speeds of the rowing stroke itself. Data collection and analysis should be complete before August and will be presented at the conference.

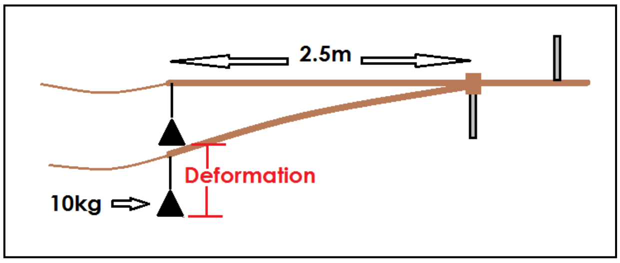

Figure 1: Concept2^{TM} classifies stiff, medium, and soft oar-shafts by suspending a 10kg (98N) load 2.5m from the gate. Retrieved from www.concept2.com/oars/oar-options/shafts/stiffness.

CONCLUSIONS

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REFERENCES

1. Brearley, M. N., & De Mestre, N. J. (2000). Improving the efficiency of racing shell oars. *Mathematical Gazette* **84**: 405-414.
2. Hofmijster, M. J., De Koning, J., & & Van Soest, A. J. K. (2010). Estimation of the energy loss at the blades in rowing: Common assumptions revisited. *J. Sports Science* **28**: 1093-1102.
3. Kleshnev, V.I. (2007) Question & Answer. Rowing Biomechanics Newsletter, No.80 Volume **7**. www.biorow.com. Retrieved November 1, 2012.
4. Macrossan, M.N. (2008). The direction of the water force on a rowing blade and its effect on efficiency. University of Queensland Mechanical Engineering Report No.03.
5. Sliasas, A. (2011). Modelling the effect of oar shaft bending during the rowing stroke. In Proceedings of the Institution of Mechanical Engineers, *Sage Publication*, **225**(4): 265.

Table 1: The amounts of oar-shaft bend for each stiffness level. Actual bend within 0.25cm of the listed below. Retrieved from http://www.concept2.com/oars/oaroptions/shafts/stiffness.

Stiffness Option	Measured Oar-Shaft Bend
Extra-Soft Stiffness	6.5 cm
Medium Stiffness	4.5cm