SCULLING EVENTS ARE FASTER THAN SWEEP ROWING EVENTS DUE TO A HIGHER POWER OUTPUT

Hofmijster Mathijs¹, van der Scheer Jan², Voorn Eric², van Soest Knoek²
(Institute for Fundamental and Clinical Human Movement Sciences¹, Institute of Clinical and Fundamental Human Movement Sciences², Netherlands)

INTRODUCTION

The disciplines in competitive rowing can be divided into sweep rowing (one oar per rower) and sculling events (two oars per rower). From the world records it appears that sculling is the faster style. The difference in WR-times between the double sculls (sculling) and the coxless pair (sweep) is 11 seconds, equivalent to a velocity difference of 0.16 m/s (3%). Since hull drag \( P_{\text{drag}} \) relates to shell velocity \( v \) according to \( P_{\text{drag}} = -k \cdot v^3 \) this implies that \( P_{\text{drag}} \) is almost 10% higher in the sculling event.

The power equation for steady state rowing can be written as \( P_{\text{rower}} \cdot \eta_{\text{gross}} = k \cdot v^3 - P_{\text{blade}} \) [1], with \( P_{\text{metabolic}} \) the metabolic power production, \( \eta_{\text{gross}} \) the gross efficiency and \( P_{\text{blade}} \) the power loss at the blades during push-off. Assuming equal effort, possible causes for the difference in velocity can be identified: power output \( (P_{\text{rower}}) \) can be different \( (P_{\text{metabolic}} \) and/or \( \eta_{\text{gross}} \) differ); at a given velocity, hull drag is different \( (k \) differs) and/or \( P_{\text{blade}} \) is different.

The aim of this preliminary study was to investigate if differences in \( P_{\text{rower}} \) between both rowing styles can explain for the difference in shell velocity. Differences between kinematics were also investigated. Data were compared using paired sample t-tests.

METHODS

9 Well-trained rowers (5 M, 4 F) participated. A rowing ergometer was modified such that it enabled both sculling and sweep rowing movements. Due to equipment limitations, only the last phase of the stroke was investigated. In this phase the legs are extended and the rower only uses the back and arms. Sculling and sweep rowing experiments were performed on separate days. For both styles, \( \eta_{\text{gross}} \) was determined during 3 minutes rowing at submaximal effort \( (RER \leq 1.0) \). This was followed by a 1 minute trial at maximum effort during which \( P_{\text{rower}} \) was determined. Kinematic data of joints were obtained in 3D.

RESULTS AND DISCUSSION

\( P_{\text{rower}} \) and \( \eta_{\text{gross}} \) were higher for sculling \( (P_{\text{rower}}: 231 \text{ W vs 207 W}, P<.05; \eta_{\text{gross}}: .14 \text{ vs } .13, P<.01) \). During sweep rowing, total elbow flexion of the elbow closest to the oarlock was significantly smaller than that of the other elbow and than both elbows during sculling. No differences were observed between the ‘outside’ elbow in sweep rowing and both elbows in sculling. Translation of the neck in relation to the hip was significantly larger for sculling, suggesting a larger contribution of the back.

The results show that differences in \( P_{\text{rower}} \) and \( \eta_{\text{gross}} \) can at least partly explain the difference in velocity between sweep rowing and sculling. The difference in \( P_{\text{rower}} \) in our study was 11%. This appears to be related to a better use of both arms and the back. If this difference maintains when the legs are also used remains to be investigated. To investigate whether power losses differ between sweep rowing and sculling, on-water measurements are necessary.

REFERENCE

1. Ingen Schenau and Cavanagh, J. of Biomech. 23:865-81, 1990

Keywords: Sports Biomechanics, Energy Production, Rowing