

Sykes Racing 2008 Rowing Australia  
**Coaches Conference**



# The Rowing Ergometer; It's Relevance to Training and Testing

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1. Discussion of some fundamentals about the rowing ergometer
2. Presentation of Drag Factor study results
3. Advice & recommendations

***I AM NOT HERE TO TELL YOU TO STOP USING THE ERGOMETER!***

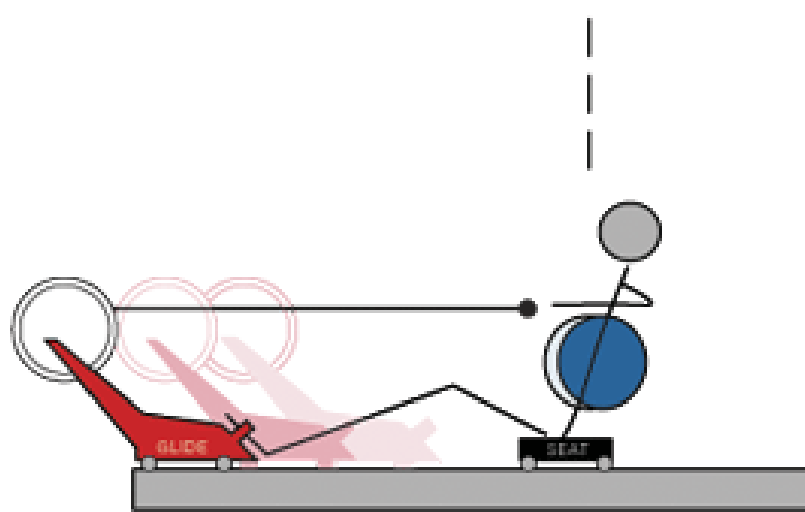
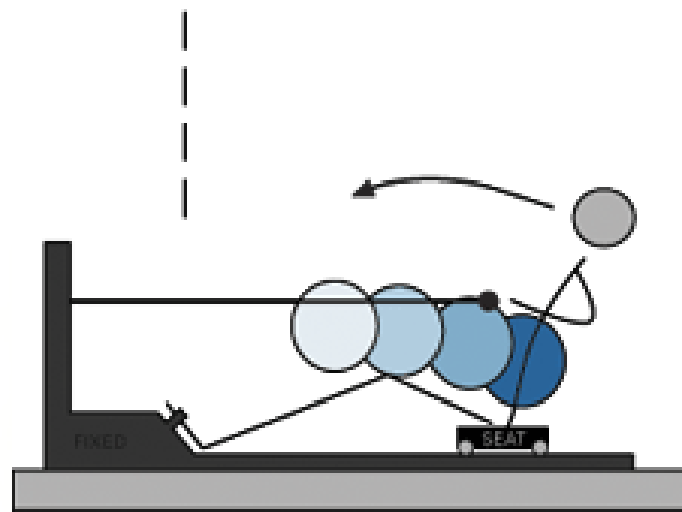
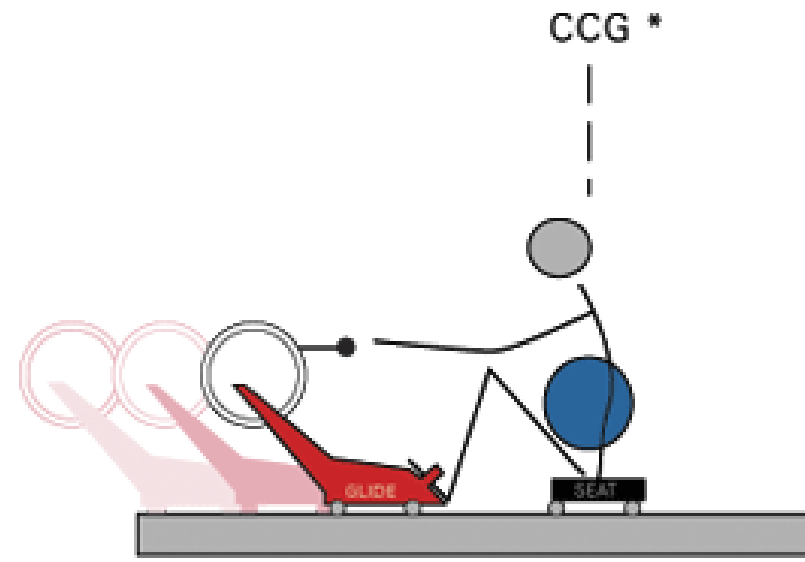
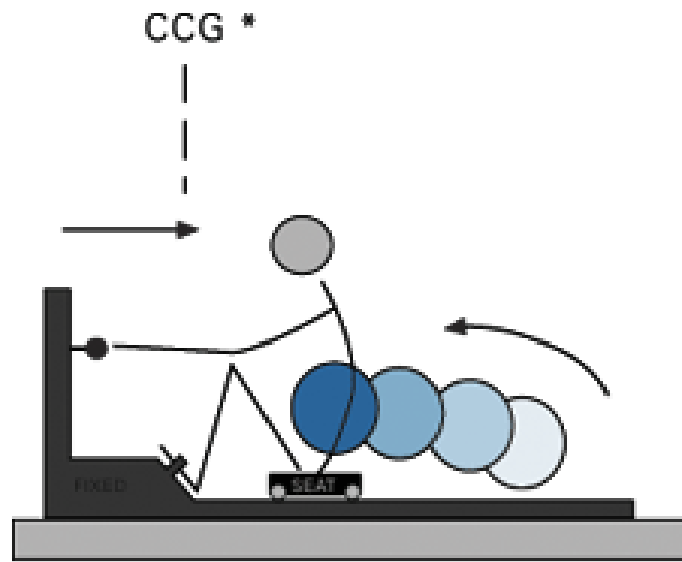
## Does it accurately reflect what happens on water?

- Kleshnev (2001, 2003, 2005) lists six key differences
  1. Stroke rate is always 10-15% lower \*
  2. The stroke length is 3-5% longer \*
  3. Handle force has a higher peak and develops later
  4. Handle and footstretcher forces nearly equal as opposed to footstretcher force on water being 30% higher
  5. Difference in the timing of stretcher and handle forces \*
  6. Maximal legs velocity is lower on an ergometer \*

\* a dynamic ergometer significantly alters or eliminates this difference

*“Rowers with fast legs produce more power on water, while athletes with slower legs and stronger upper bodies have relatively higher ergo scores”*

# Fixed vs Dynamic Ergometers



# The rowing ergometer



- While static ergometers may have been useful for training physical fitness, they may also adversely alter the coordination of the muscles used in on water rowing. (Elliot, 2002)

# Fixed vs Dynamic Ergometers



- Bernstein et al, 2002
  - Athletes rowed average 53mm longer on a fixed ergometer
  - As pieces progressed, there was an increase in stroke length at the catch on a fixed ergometer
  - The mean forces developed during the power phase were significantly higher with the fixed ergometer
- Colloud et al, 2006
  - Rowing on a dynamic ergometer seems to require different muscular coordination to produce external force contact patterns
  - The lower catch and maximum values for external contact forces on a dynamic ergometer could decrease the risk factors for injuries



- Teitz et al, 2002
  - Ergometer training for longer than 30 mins was the most significant and consistent predictor of back pain for all age groups
- Holt et al 2003
  - 5% increase in lumbar flexion during a one hour ergometer at training intensities
  - Attributed to fatigue of the lumbar muscles
- Reid & McNair, 2000
  - The combination of lumbar flexion and muscular fatigue has long been identified as a cause of lumbar spine injury amongst rowers

- Bernstein et al, 2002
  - In elite rowers, land based training carries a 10-fold higher risk of injury per hour than water based training, the leading causes suggested being weights and ergometer training
- Wilson et al, 2008
  - Time spent ergometer training had the most significant impact on injury risk
  - This confirms biomechanical observations that the loading to the joints in ergometer sessions is different to the patterns seen on water
  - Nov, Dec & Jan highest months for injuries and this is related to high volumes of land training during winter months



***If we can confidently say that the ergometer is not the same as on water rowing, and that it is clearly linked to injury, isn't it time we did something about it?***





- Ergometer testing is often completed at stroke rates well below on water race pace
- Many athletes report the current drag factor (DF) settings feel too heavy
- Many coaches now prescribe ergometer training at lower DF's
- There is increased interest in using the Concept II sliders as training tools

# What Do Crews Rate?



## 2007 World Championships

Class	SR	Class	SR
M8+	40	W8+	39.1
M4-	40.5	W4x	37.4
M4x	39.3	W2x	35.9
M2x	38.2	W2-	37.4
M2-	38.8	W1x	34.1
M1x	36.3	LW2x	36.1
LM4-	40.6		
LM2x	38.8		



- Small study designed to add some knowledge to the following questions:
  - Are the current drag factor settings appropriate?
  - What effect do Concept II sliders have on stroke rate?
  - Can we manipulate DF +/- sliders to get stroke rate closer to on water race rates?
  - Are Concept II sliders a reliable form of testing?



# On Water vs Ergometer?



- Can we compare forces?
- Assumption
  - If we manipulate variables to get rate similar to on water racing, then forces must be close to similar

# What Would Change?

- Perhaps a test that is more predictive of on water performance??
- A training tool that may be closer to enhancing the correct skill pattern??
- Likely decrease in low back injury rates!!

# Reference List



1. Bernstein, I. A., O. Webber, et al. (2002). "An ergonomic comparison of rowing machine designs: possible implications for safety." Br J Sports Med **36**(2): 108-12.
2. Colloud, F., P. Bahuaud, et al. (2006). "Fixed versus free-floating stretcher mechanism in rowing ergometers: Mechanical aspects." Journal of Sports Sciences **24**(5): 479 - 493.
3. Dudhia, A. (1999). "The physics of rowing: dynamic vs static ergometers." from <http://www.atm.ox.ac.uk/rowing/physics/index.html>.
4. Elliott, B., A. Lyttle, et al. (2002). "The RowPerfect ergometer: a training aid for on-water single scull rowing." Sports Biomechanics **1**(2): 123-134.
5. Hollinger, N. R., I. Marchand, et al. (1995). A comparison of kinematic and kinetic performance among athletes during ergometer rowing. Aviron Canada Rowing. **1995**: 9-13.
6. Holt, P. J. E., A. M. J. Bull, et al. (2003). "Kinematics of Spinal Motion During Prolonged Rowing." International Journal of Sports Medicine(8): 597-602.
7. Howell, D. W. (1984). "Musculoskeletal profile and incidence of musculoskeletal injuries in lightweight women rowers." Am J Sports Med **12**(4): 278-82.
8. Kane, D. A., R. L. Jensen, et al. (2008). "Effects of Drag Factor on Physiological Aspects of Rowing." International Journal of Sports Medicine(5): 390-394.
9. Kelshnev, V. (2003). Discussion of ergometer rowing vs on water rowing. Rowing Biomechanics Newsletter. **3**: 1.
10. Kelshnev, V. (2005). Discussion of ergometer rowing vs on water rowing. Rowing Biomechanics Newsletter. **5**: 1.
11. Kleshnev, V. (2001). Discussion of ergometer rowing vs on water rowing. Rowing Biomechanics Newsletter. **1**: 1.
12. Lamb, D. H. (1989). "A kinematic comparison of ergometer and on-water rowing." Am J Sports Med **17**(3): 367-73.
13. Mahony, N., B. Donne, et al. (1999). "A comparison of physiological responses to rowing on friction-loaded and air-braked ergometers." J Sports Sci **17**(2): 143-9.
14. Marsden, J. (2006). 2 in 1 Results: Slider vs fixed Concept II. NSWIS Rowing Coaches Workshop. Sydney.
15. Reid, D. A. and P. J. McNair (2000). "Factors contributing to low back pain in rowers." Br J Sports Med **34**(5): 321-2.
16. Rumball, J. S., C. M. Lebrun, et al. (2005). "Rowing injuries." Sports Med **35**(6): 537-55.
17. Teitz, C. C., J. O'Kane, et al. (2002). "Back pain in intercollegiate rowers." Am J Sports Med **30**(5): 674-9.
18. Wilson, F., C. Gissane, et al. (2008). "A 12 month prospective cohort study of injury in international rowers." Br J Sports Med.

