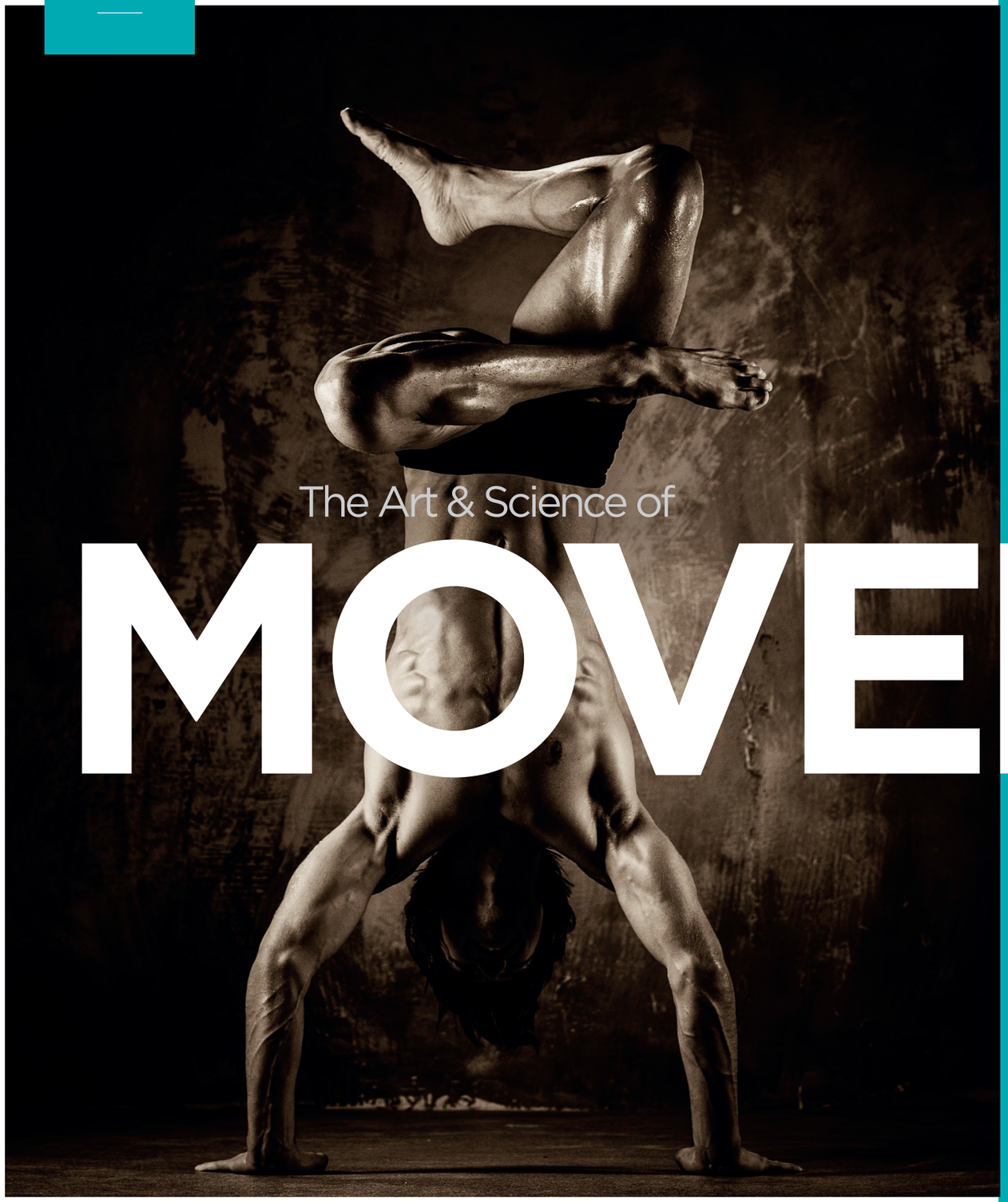


The Art & Science of MOVEMENT

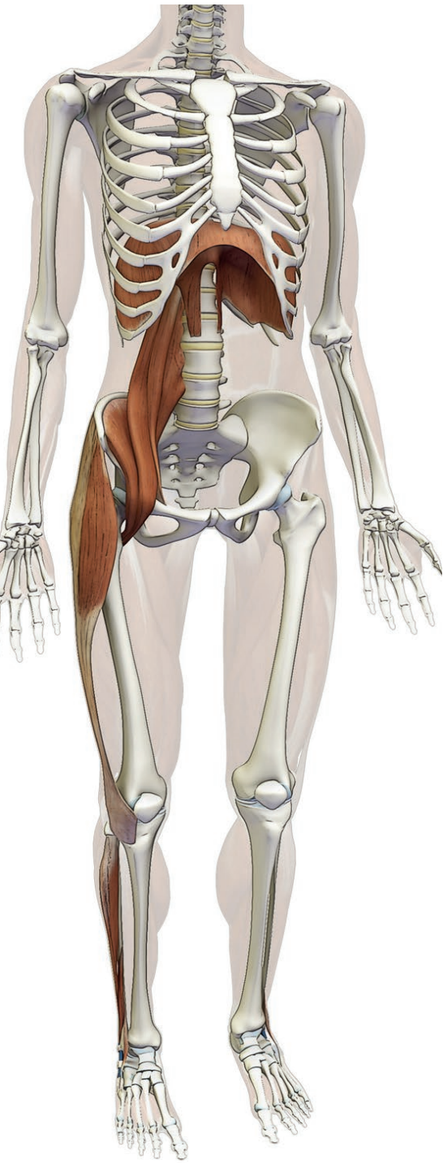
Small adjustments to the way we use our bodies can dramatically improve performance and reduce injury. By Dr Edmund Wittich.

In every sport – or every movement, for that matter – our entire body is being used, with its unique set of mechanics. The body moves in sport as in life: in a continuous, unique and nuanced manner.

However, no one sport above rowing has sought to combine a wider range of sequenced movements from upper and lower segments in a pattern that links together over a repeated time cycle, to create a synergistic force which is transferred through the body, to drive a piece of equipment that the body is a part of. Certainly no sport has sought to do all this and add the ever-changing and often unpredictable 'field' that is the water into the equation.

To watch good rowing is to witness the art of science in motion. No one rower looks the same, even at the Olympic level. The athlete uses her or his unique body structure and biomechanics to create her or his own (or the coach's) perfect stroke. He or she relies on using individual movement strategies to produce the same result: speed and efficiency. It is amazing to note the variation of body types and stroke styles and still see such close finishes in races world-wide.

The body is an incredible structure. Each part is so interlinked with the next that small positional changes at the extremities can affect the way an athlete breathes, feels stress, or fatigues; it →



Above See how lines of tension and connections can be traced from the leg muscles and hip flexors right up to the large diaphragm muscle that drives breathing – imagine the effect a slumped spine or leg length difference can have on the physiology, let alone movements of the rower.
Image courtesy www.dailybandha.com

STRUCTURE GOVERNS FUNCTION & VICE VERSA.

even affect the ability to apply a maximum force. Structure governs function and vice versa in this dance of muscles, bones, joints and connective tissue. Do we ever think of what the body is having to do to create this movement on a deeper level? Why does one athlete always dip the boat to port, or another seem to completely change stroke pattern and style at the 1750m mark? Do we ever really recognise the individual in the pursuit for speed, not just in the 1x but in all crew boats? From our experience working at all levels in the sport, we would say not enough.

Could that be why the injury rate is so high at all levels? Especially in the lumbar spine – the cantilever link for force production and transmission between the pelvis and lower limbs, to the more mobile mid spine and upper limbs, which attach to it and work with it to produce the pull on the blade that we are screamed at to 'PULL HARDER!'

MRI-based rowing studies have reported up to 85% of athletes tested in their populations having positive MRI results for disc herniation, and noted lumbar spine levels of degeneration, compared to 20% for the age-matched non-rowing population. The lumbar spine accounts for at least 15-25% of all rowing injuries, with rib injury affecting around 10-12% of rowers. Of these we believe between 70-79% are overuse injuries.

We also know that rowers with skill levels lower than elite are more likely to get injured overall, particularly at the spine. Many of these injuries can end participation in the sport, and may have ongoing debilitative effects on the general lives of these athletes. The elites do more distance and get more rib stress fractures, but it is our school and college kids who are getting injured more often in most cases.

Even if they don't leave the sport, they likely carry ongoing injuries, and as a result have a higher chance of more serious injury later in their rowing life. Who knows what some of our best rowers in history could have done if they were not affected by spinal injuries? Maybe if we set them up properly as kids, noting their body's needs, they would not have been. A scary thought for competitors racing the "Drew Ginns" of the rowing world.

The new theme in sport, in parallel with other industries like IT, is tailored individualisation. That is why data reigns so supreme in sports science and health now: many sports are developing ways of understanding and tracking the individual nuances of how and why an athlete performs the way they do. The World Cup in Brazil was a great example, with teams using sophisticated video systems to analyse their own movements, patterns of play and injuries (as well as other teams') during matches and training.

You don't have to be as high-tech as that to start having an impact on your rowers, however. There are many factors which can contribute to the most common injuries we see that are easy to pick up and adjust for. This is something we have a lot of experience with in working with a range of sports and, thankfully, things are changing for the better in rowing.

Leg length discrepancy is one of these factors. We have tested over 2000 athletes from school to elite level, and have noted power and leg length discrepancy effects in upwards of 85% of them. This correlates with stats on discrepancies in the general public, but also shows that function is affected by many of these discrepancies when rowing. We know that asymmetries at the foot-stretcher have been seen to significantly influence lumbar-pelvic kinematics (movements) and pelvic twisting during elite rowing, and that this can have an impact on not only injury but performance as well. Leg length issues can easily be observed by the watchful coach or trainer – differing knee heights at the catch or often one leg coming up higher than the other at the finish, a certain standing posture, etc. Measurement can be quickly done by a health practitioner or trainer.

Greater overall movement of the lumbar spine into flexion (bending forward at the catch) and the range of flexion-extension (catch-finish) in the stroke are also noted to increase the risk for (and in some studies are even predictive of) lumbar injury. Correct kinematics can be taught and learnt – so an observant coach and a focused trainer are invaluable.

A final and even easier factor to address is shoe size. As simple as this may sound, in rowing it is often ignored or accepted that you will be jammed into a shoe that is too small or far too large for you because it is easy and it takes time to adjust sizes. Sometimes coaches don't even know the shoe sizes of their crews and just assume they will be fine in whatever is in the boat. The problem with this is that the shoe is your leg and foot's connection to the boat; it forms the base of support for the stroke and dictates the position and movement of the lower limb to pelvis. The foot stretcher is where the highest force will be applied. If you are slipping around inside a shoe that is too big then you are losing performance and increasing the demand of your muscles to stabilize your position – this makes a good connection harder. It may put more load on the system which could lead to injury. The shoe is too small? Well this means your toes are cramped and the foot cannot be in its most effective position to transfer the leg force being applied, leading to muscle compromise higher up the chain and – guess what – lost performance and possible injury risk again.

The key in all of this is in understanding and accepting that all people move differently and use different strategies in producing their movement. One size does not fit all. In a running project we are working on with an Australian University and elite Australian Rules Footballers we have found these four factors are the key to injury risk:

1) The position of the limb during foot strike.
2) How the limb responds following foot strike.
3) The state of the body's tissues and their ability to respond to loading stresses.
4) The body's ability to make subtle variations to minimize fatigue and overuse.

These are applicable to rowing too:

1) The position of the limb and body during the drive and especially at maximum handle/foot force (MHF).
2) How the limbs and trunk respond following the initial drive/MHF/arm draw, etc.

We hope the sport continues to evolve and improve, and we want to help this with our further work – in particular, making individual adjustment easier for rowers and coaches alike with our equipment innovations, like the new Quick Release ShoePlate Pro. We are excited to see others doing the same. This will change the sport and can only help to lower the injury rates as our understanding and ability to adjust for the individual improve.

You, as a coach, rower, trainer, or individual can help too by opening your mind up to the fact that rowing can move forward and be better focused on the human factors of the sport. Let's work to fully convert the art of science and movement into better performance and health for our athletes – the results will enhance the sport we love. ROW360

Dr Edmund Wittich is a doctor of osteopathy with a Masters in lower limb biomechanics. He has worked in performance consulting for rowing across numerous colleges, elite clubs and Olympic teams in his role at BAT Logic.

BELOW An example of a foot force graph taken from BAT Logic athlete analysis – note the difference in left versus right forces.