PEDAL POWER

Andrew Hamilton explains new research suggesting that triathletes should look at their left/right pedalling symmetry...

A large imbalance between left and right pedal strokes can cause premature fatigue

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CADENCE
The rate at which you are pedaling, expressed in revolutions per minute (rpm).

BIOMECHANICS
The forces applied to your body during exercise.

NM
Newton metre – a unit of torque.

Of triathlon's disciplines, swimming is the one that demands the most attention to technique. An inefficient stroke will greatly reduce your velocity through the water and increase your injury risk. A decent running technique on the other hand is something that tends to come fairly naturally and only really becomes the focus of attention when injury strikes.

The importance of good cycling form is widely recognised, too. However, most of the advice is about the correct use of gears, optimum pedalling cadence and how to adopt the best aero position in order to slice through the air with minimal resistance.

In terms of the actual pedalling motion, there's very little advice on offer – unsurprising perhaps, because, by sitting on a bike with your feet clipped into the pedals, your muscle and joint movements are precisely controlled and symmetrical on each side of the body. This, of course, contrasts sharply with the other two disciplines, where the movement of the limbs has to be coordinated by the brain and neuromuscular system, and where asymmetries can easily develop over time, leading to injury.

However, recently published research suggests that symmetrical riding position and movement doesn't necessarily equate to symmetrical biomechanics, which could result in an increased risk of overuse injuries and premature fatigue during longer or harder rides. In the study, carried out at the University of Reims-Champagne-Ardenne in France, scientists studied the pedalling biomechanics of 11 masters cyclists who regularly performed long training rides and raced long-distance cycling events.

The researchers particularly wanted to see whether the cyclists typically pushed harder on one leg – that is, applying more torque (turning force) to either the left or right crank. To do this, the cyclists were asked to complete an incremental cycling test, during which the forces applied to the left and right cranks were measured at varying levels of power output.

PEDAL TO THE METAL

The cyclists, whose average age was 53, were very experienced and considered themselves to have good technique. None of them had sustained injuries prior to the study or were aware of any reason why they might have asymmetric pedalling biomechanics.

The 18min incremental test consisted of 10mins at 100 watts; 3mins at 150 watts; 3mins at 200 watts; and 2mins at 250 watts. The test was conducted on a road bike equipped with an SRM crank system in order to very accurately measure applied force and power as the cranks rotated. The rear wheel of the bike was mounted in a Tacx ergometer and the bike was adjusted so that each rider could be in his optimum position. During the test, the researchers recorded the average force applied by the riders at each point of the crank revolution for both sides (see left).

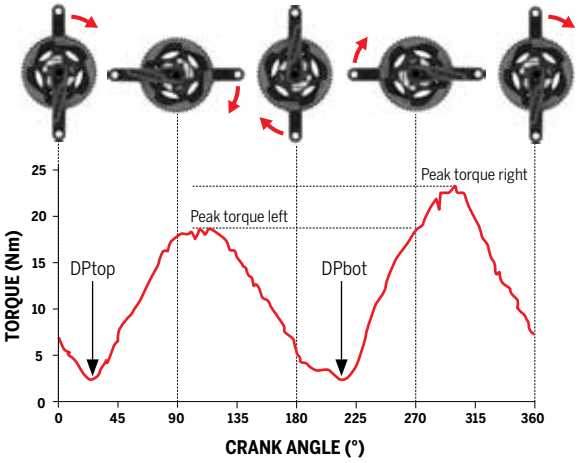
When the data was number-crunched, an index of asymmetry was produced for each rider, where a score of 0% asymmetry equates to perfect symmetrical biomechanics. Ideally, an asymmetry score of less than 10% is considered desirable for efficient pedalling. However, except for one subject, the asymmetry scores were all significantly higher, regardless of the power level. Across the group, the average asymmetry score measured 30% at 100 watts, while at 250 watts it averaged 23%. Only one rider consistently achieved an asymmetry index score of less than 10%.

That there was left/right pedalling asymmetry wasn't unexpected. However, the degree of asymmetry surprised the researchers, not only because it was apparent at all power outputs and affected all but one of the group, but also because of the size of the left/right discrepancy in some of the subjects.

Putting aside the increased risk of injury, a large imbalance in force production between left and right legs is a recipe for premature fatigue; having one leg working harder to compensate for the other is always going to be a less efficient way of producing sustainable power than if both legs work equally hard. Given these results, it could be a good investment of time to check your pedalling biomechanics. **220**

TORQUE CURVES

The actual torque vs crank angle curve for one subject in the study. Notice the different shapes of the curves and how peak torque for the right crank is much higher than that for the left leg



TAKEAWAY TIPS

- Don't assume that just because you 'feel' your left and right legs are working equally hard, they actually are. Try to get an actual measurement made at the kind of power output that you use during training (some stationary bikes offer this facility).
- If a significant asymmetry exists, add some strength training to your programme. Studies show that strength training for the legs (in addition to normal cycling training) can improve the pedalling efficiency and symmetry.
- If you have access to a bike that gives you real-time info on left/right torque (such as Wattbike), try some 'torque feedback' sessions, where your goal is to keep the torque output on left and right sides as similar as possible. This can be very effective.

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