Get shorty

170mm? 175mm? Most bicycle cranks are too long. Upright or laid back, the short-crank spin is the way to win, suggests Mike Burrows

When Archimedes claimed to be able to move planets, given a long enough lever, he had no intention of changing the earth's orbit. He was just making a point. And to some effect: the media has always liked a good one-liner and this one is now burned into our consciousness to the point where we tend to think: long lever equals more power.

Likewise in the collective cycling brain: long cranks equal more power. But do they really? Well, no. It's not that Archie was wrong, but that our interpretation was wrong – mostly on account of his one-liner. The one-liner you need to bear in mind is the first law of physics, i.e. there is no such thing as a free lunch.

LONG AND SHORT OF IT

Levers do not increase power. They only alter the way it is used. For example, if you apply a force to one end of an 11-metre lever with the pivot one metre from the other end you will generate ten times the force that you put in (less frictional losses at the pivot and bending in the lever). However, the other end will move one tenth the distance that you move your end.

'Power' is force multiplied by speed, which for us cyclists is very important. For example, let's say you have a 50T chainring and 100mm cranks. For a given pressure on the pedal you will travel x distance in y time. You then change to a 100T ring and 200mm cranks, so that for the same pedal pressure you should travel $2x$ distance in y time. Or do you?

What actually happens is that your foot, which is by now on the end of a 200mm crank, has to go twice as far to complete a

Photo: Seb Rogers

revolution, which will of course take twice as long – assuming the same pressure on the pedal. You will in fact be back to square one, hopefully understanding that changing crank length is just the same as changing gear.

Or it would be the same but for one thing: the source of the power, the clever monkey on top of the saddle. We don't know how we work best, or how to get the most out of our aching, power-limited bodies. But some of us are starting to understand that it does not involve longer cranks but shorter ones – much shorter.

SMALL IS BEAUTIFUL

It all started with a young German, Frank Lienhard, who decided that the aerodynamics of an HPV (Human Powered Vehicle) were so important that maybe losing a bit of power would be an acceptable trade off. When lying on your back on a faired recumbent, your feet on the pedals largely determine the size of the fairing. So Frank cut his cranks down to 110mm. Not that Frank is very tall, but even so: 110mm!

Frank did not win that year, although he did quite well. What he realised was that to get the best out of his diminutive sticks he would have to start training on them. This was when it got interesting. For after about a month they not only felt 'normal', but even on his unfaired trainer he seemed if anything to be going faster rather than slower. This idea became relevant to me shortly afterwards following an operation my son had to replace a knee joint. After the op, his ability to bend the leg due to tendon damage was limited. It was impossible for him to ride on 170mm cranks. So I made some 125s and, again, after about a month he was quite at home on them. I also made up a set of 125mm cranks for myself but as I was at the time working for Giant and having to ride lots of different bikes I never adapted to them.

Years later, having left Giant and gone over to the dark side completely by not only riding but building recumbents for a living, I took another look at the idea of short cranks. By now, others were racing on anything down to 100mm and training on 75mm cranks. I decided to be a bit less ambitious and settled on 150mm as I still make cycles for other people and so have to stay in touch with the world of 170s.

Putting them first on my Ratcatcher 9 touring recumbent, I went off on an 80-mile ride. It was very interesting. There was no learning curve. They felt quite natural straight away, and even felt if anything a bit faster. I had, by the way, reduced the chainring size by two teeth so could use otherwise the same gears as before. I then fitted the same 150mm length to my 8Freight load carrier and 2D city bike, both of which felt a little odd for a week or so. After that, everything else felt a little odd.

I then built two new Ratracer recumbents for racing, and fitted both training and race models with 145mm cranks – to equally good effect. Not that I win anything, but I am an old man! Most interesting, I think, is that I can shorten my cranks by 25mm and not notice any major effect at all. They're a bit nicer and maybe a bit faster, that's all. So to anyone out there thinking they might need 172.5mm cranks: this is 'Princess and the pea' syndrome. You will not notice *anything*.

Photo: Peter Eland

SHORT-CIRCUITED?

Not everyone in the recumbent world has changed over yet, but everyone who has is very glad they did. Shorter rather than longer certainly seems to be the answer for the laid-back brigade. Not that we have any more science to prove it than the boys on uprights have for their 170s.

Testing has been done but is inconclusive. It appears to have been done over short periods of time, not allowing for the weeks that might be needed to adapt to the shortest cranks – 100mm or so. But the evidence we have suggests they are a good idea, and not only for the laid-back. Those on uprights could also benefit, not only with more power but (for racers) better aerodynamics, because the reduced leg movement and higher saddle position should allow riders to achieve a lower tuck position. And of course the cranks are smaller and lighter, the rings are smaller, and there's less chain, so you get weight savings. According to the doctors, they should be better for our knees, too.

Why should they give more power? This is speculative but we do have an idea of how our bodies work, and in many ways they're not unlike the bane of our life: the internal combustion engine. In particular, we have to get the fuel (oxygenated blood) to and from the muscles, which has to involve some sort of timing.

Imagine pushing very hard with your leg. You can kick or do it with a steady push. When you have relaxed the muscle the blood will flow through it, which it can't easily do when it is tensed up, and wash away the lactates and provide fresh energy. If you do this once a minute, your heart and lungs will not be overburdened. If, however, you try to do 1,000 pushes a minute, they will not keep up. Somewhere between the two is the ideal speed to optimise your system.

Going back to our sample crank lengths: the 200mm crank took the same time to do one revolution as the 100mm one did for two. So the longer crank had only one chance to refuel, and the heart and lungs were likely not fully used.

The other possibility – as all of this is a bit of guessing by a clever monkey more familiar with carbon fibre and aluminium – is that by shortening the power stroke we are getting nearer to a 'punch' than a 'push', which may be a good thing.