



HOW CAN I BE A BETTER CYCLIST RIGHT NOW?

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What can I do to be a world class rider today? Is there one thing I could do right now that would put me on the road to future success? Yes, there is something you can start today and get meaningful results by the end of the week. What is it? ***Learn to pedal correctly and learn to maintain your technique during your training sessions and races.*** Sounds simple right? If you are interested in making a permanent change....read on!

Pedal Technique:

It will take thousands of hours of correct pedaling technique to ingrain the correct neural and muscular patterns necessary to produce a coordinated and effective movement. To maximize performance, you must be constantly concentrating on pedal technique throughout every training session. It will take up to 10 years of focused effort to pedal as efficiently as world class rider.

To pedal with maximum effectiveness, you should be focusing on two concepts:

- 1) Minimizing the dead-spot at the bottom-dead-center and top-dead center of the stroke.
- 2) Constant force generation from both legs – working as a single unit.

Minimizing the dead-spot at bottom dead center and top-dead center is a major concept in pedal technique. All cyclists have this dead spot and it may be impossible to eliminate it entirely from the pedal stroke. Research has found that world-class cyclists are able to reduce the dead-spot by accelerating through the bottom half of the pedal stroke. Typically, this is done by “pulling back” on the pedals in a motion that is similar to “scraping mud off the bottom of your shoe”. This movement uses the hamstrings to pull and gives the sensation of lessened force on the down phase of the opposing leg. Several athletes begin to explore this technique, but the lightened sensation in the quadriceps leads them to believe that they are not pushing as hard as they could be and are therefore slower. While this may be true during the initial acquisition of the skill, later phases of mastery will actually result in improved power delivery.

To work on this skill, riders should use one-leg pedaling drills. In these drills, the rider unclips one foot while pedaling with the other foot. You may also choose to simply concentrate on the pedaling action of one leg and then the other. This drill will highlight any dead-spots in the pedal stroke by causing pauses and awkward skips in the pedal stroke. You may experience dead-spots in any phase of the pedal stroke but the most pronounced will usually be found when the crank arms are in a perpendicular position to the ground. Again, the idea is to pass through any dead spots as quickly as possible.



Cue Phrases for passing through the bottom dead center and top dead center phase of the pedal stroke:

- 1) *"Pull back"*: Focusing on pulling with the hamstrings from 9 to 3 O'clock pedal position
- 2) *"Kick over"*: Focusing on pushing forward from 3 O'clock and over the top to 9 O'clock position

Integration

It is important to transfer the skills and feedback from single leg pedaling to the full pedal stroke. Riding with both feet clipped in, you will focus first on "pull back" for 5-10 seconds and then on "kick over" for 5-10 seconds. Next, you will combine these movements into a full pedal stroke for 5-10 seconds. This takes a considerable amount of energy, concentration and skill. The result will be increased speed and slightly increased cadence.

In the initial phases of learning this technique, you may be deterred by the energy expenditure that this attention to technique places on the muscles and mind. Athletes usually do not get very far with this skill and often revert back to simply pushing down on the pedals. If you are patient and perseverant, you can learn to pedal smoothly and efficiently with this technique. At first, you will only be able to maintain it for very short periods of time, but as you progress you will be able to hold it for longer and longer. Remember, an elite athlete has usually repeated correct technique thousands and thousands of time each year – often for 10 years or more. ***Every time you ride without paying attention to correct pedal technique, you drift further and further away from fulfilling your potential.***

Bio-mechanists would be very upset with this overly simplified description of the problem areas in pedal technique. They might point out that you are not actually pulling back or kicking forward in the pedal stroke. Remember we are talking about ***cue words*** and descriptions that are designed to ***coach*** correct form. These are descriptions used by the coach in order to provide a memorable way of relating and creating improved technique. I once had a National level coach, while I worked at the Olympic Oval National Cycling Center, point out that these cues were not what was actually happening in the pedal stroke. I agreed with him but pointed out that much of what actually happens in a pedal stroke comes as a result of the bicycles construction (the way the cranks are made). Of course you cannot actually push forward or pull back when the cranks will always produce (no matter how bad you are) a round looking pedal stroke. The cues I was shouting were for the athletes – not their bicycles! Statistical and scientific theory on force application in pedal strokes are readily available to anyone who is interested....coaches apply this knowledge in a unique way that athletes can understand and use.



Slow to Fast

Another simple way to learn proper pedal technique is to ride slowly in a moderate to heavy gear on a flat road. The slower pedaling speed will allow you to feel each distinct movement in the pedal stroke. As you become accustomed to these motions, lighten the gear while continuing to emphasize technique. Continue moving to lighter gears until you feel that you cannot maintain correct technique any longer at that cadence. Start the drill over again in a moderate to hard gear and repeat. You should feel your skills improving on each round. Remember, it will take years of this work to gain world-class pedaling form.

How do my calf muscles contribute?

The calf muscles control the lever action of the foot. For the most part, the calf controls the muscles of the lower leg and foot so that power can be transferred efficiently from the quads, glutes and hamstrings and into the pedals. There is some "pawing" action under heavy loads and low cadences (such as slow speed - steep climbs on the MTB) but generally, the calf muscles are there only to assist in power transfer and the fluidity of pedaling. Under extremely high cadences, such as in track sprinting (165+rpm) the calf muscles are actually tightened so that there is almost no contribution from either the calve or the foot in the pedal action. I suspect this is because added joint action in the ankle and increased levering of the foot causes a slowing action in the pedal rotation. This same control of joints is noted in track and field sprinters where sprints are done on the toes with the calves contributing only to the push off at the start and then less and less as the runner accelerates.

Other types of feedback for pedal technique:

- 1) Cycling computers and heart rate monitors
- 2) Rollers
- 3) Wattage
- 4) Power Cranks
- 5) Rotor Cranks

Cycling Computers and Heart Rate Monitors:

I was a guest speaker at the World Triathlon Coaches symposium in Edmonton during the 2001 World Triathlon Championships. I was speaking about the development of skills and pedal technique with junior cyclists using rollers. I was fortunate enough to hear Dr. Edmund Burke speak in one of the preceding lectures. Dr. Burke spoke about the importance of correlating wattage, speed, cadence and heart rate to performance. Dr. Burke had done analysis on Lance Armstrong's pedaling technique (as it was just coming into vogue) and asserted that Armstrong was pedaling at very high heart rates as a result of his higher than average pedaling cadence. He noted that while higher heart rates might lead many athletes to back-off, Armstrong maintained the cadence because the resulting increase in wattage was at an acceptable cost in terms of heart rate and perceived exertion. In simple terms, if his heart rate went up 10 beats but wattage jumped 30 watts then it was worth the added cost of the effort. Dr. Burke reinforced the concept that



wattage or speed must be understood in the context of energy cost to the athlete (heart rate in this case). Sometimes it is acceptable to go over one's red-line for an exponential jump in speed or wattage.

If you are trying to figure out the correct pedaling technique, it can be as inexpensive and easy as getting a cycling computer and a heart rate monitor. Start by riding a known loop of 1-2km with your current pedaling technique. Take note of your average speed, cadence (if possible) and heart rate. Now, apply the correct technique as described above. You will notice that your cadence and speed increase. *The question is – At what cost?* Pay careful attention to heart rate. If your heart rate jumps 5-10 beats – but speed increases 2-3km/hr – this is probably an acceptable technical improvement. If however, heart rate goes up 15 beats and speed only jumps 1 km/hr – then you are not being as efficient as you can be. Through experimentation and experience, you can determine what pedal technique increases the speed the most with the least effect on heart rate. Your computer, based on consistent conditions, will tell you immediately if you are doing correct pedal technique. Once you have done this for several sessions, you will begin to associate certain physical sensations with correct technique. After a while, you will no longer need the speedometer or heart rate monitor to tell you if you are riding correctly.

Rollers:

Rollers provide direct feedback to the athlete at all cadences. If you have lousy pedal technique, you will soon find yourself face to face with the ground. In my opinion, rollers are the best way to learn how to pedal properly. I would encourage all athletes to be on the rollers at least once a week throughout the year. The rollers help you to isolate and concentrate on your pedaling form. All of the drills mentioned above work even better on rollers.

If you find yourself bouncing around on the rollers:

- 1) Make sure you are not riding in the drops. This changes the center of gravity and weighting of the rear wheel on rollers.
- 2) Ride with technique described above. Bouncing often results from just pushing down on the pedals.
- 3) The goal is to be able to ride smoothly, without bounce, at all cadences. You should be comfortable and smooth at 140rpm minimum.

Wattage:

Wattage is the gold standard for measurement of technique through power output. If you have access to a wattage device, it will really be beneficial to your riding. Is a wattage system integral to meeting your potential? Definitely not. A reliable means of power measurement (such as SRM) is a relatively recent occurrence for cycling athletes. There have been 1000's of world class riders that were developed with nothing more than a bike and a stop watch. Many of these riders performances would still be competitive today if they were racing (i.e. Merckx and Boardman's Hour Records). The wattage testing device is an incredible tool if you can afford it, but we must remember that it means



nothing if you cannot train to your maximum potential or exceed your limits in a race. An athlete's technique, will power and dedication still wins out over most technology. That said, if you have the money, go and get the tools you need to be better!

Power Cranks:

Power Cranks offer a total immersion into the development of correct pedal technique. The independent crank arms force the athlete to pedal with both legs in a coordinated manner. This highlights one of the key aspects of pedal technique. You are not just pushing with one leg and then the other! You are learning to use both legs and your body together, as one unit, to create constant power generation. If you would like to really go the distance in terms of learning how to pedal this way, the Power Cranks may be just what you need to force yourself into being disciplined in this skill area. Power Cranks advertises the advantage of their product by stating that *"The strong leg cannot compensate for the weak one."*

Rotor Cranks:

Still think that this is too hard? You can actually buy crank arms that attempt to eliminate the dead-spots entirely. By using a ratcheting arm, Rotor Cranks help the athlete to accelerate through the dead-spots of the stroke. According to Rotor Cranks, *"Rotor Cranks work by increasing the force required on the drive side crankarm which propels the non-drive crank past the 12 o'clock point ... also known as the dead spot. This happens 180 times a minute in a 90RPM ride. Or 10,800 times an hour. The cyclist is now "permanently pushing" the cranks as there is no gap between when the legs take over push/recover duties, otherwise known as the dead spot. This elimination of the dead spot allows the rider to produce more wattage and lower his/her lactate threshold. The extra wattage is converted to speed in the amount of 2-3 minutes per 40k."* Hmmmm... not sure if we can believe all of that but think of the benefits you could get just from learning to pedal with better technique on your own bike. Rotor Crank has developed a piece of machinery worth a big chunk of change so that you don't have to think or be as focused!

Fixed Gear:

I will be the first person to tell you that riding on the track will help you to be a smoother and faster rider for any discipline. Would I advocate fixed gear training on the road as a means to improve pedal technique? No! In my opinion, you can still have terrible pedaling technique on a fixed gear bike. The construction of cranks does most of the "making your pedal stroke round". You can still push down on each leg and not use your hamstrings at all with a fixed gear. It's not that fixed gear bikes are inherently bad it's just that you still have to be focused. It's possible to have good or bad pedal technique on a free wheel or fixed gear system. If you want good technique, you have to be willing to make a conscious choice. The bike won't do the job for you.

Efficient *Cadence or Rhythm* is another important factor in pedal technique. Notice that I said *Efficient* and not *Correct* cadence. At the development level, it is simple to



recommend specific cadences (correct cadences) for specific events and athletes. As the cyclist becomes more developed, it is clear that different athletes move at different cadences while achieving the same competitive speeds and times. Individuality of pedal cadence is most important to timed events where fluctuations in speed are less frequent. For events that involve regularly fluctuating speeds and efforts, it is important that athletes adopt a cadence that favors higher RPM as this allows the athlete to be able to respond to surges and attacks more rapidly. Additionally, the longer the event, the more important higher cadence pedaling becomes. A light gear at high RPM will tax the cardiovascular system more than the muscular system. Muscular fatigue is more difficult to recover from than cardiovascular fatigue. New research even infers that “bonking” may result more from muscular damage and fatigue than simply running low on fuel. Long distance athletes – such as road racers – should adopt a cadence that focuses on efficiency - a compromise between gear size and pedaling speed that allows the athlete to minimize muscular damage and conserve energy while still permitting aggressive responses to speed changes.

When you are racing or riding in a group it is important to remember how cadence will impact the outcome of the performance. When a rider is in the pack, they should be in the lightest gear possible that allows them to keep heart rate relatively low and still stay in the draft. Often a fatigued rider will come off the front in a big gear and fail to shift to easier gears as they drift back into the pack. This can be a costly mistake as opponents may attack a rider who has just taken a pull. If that rider is still in a big gear it will make the impact of this attack more dramatic. Remember, as you drift back into the slipstream, you should also be switching into easier gears that allow your muscular system to recover from the last effort. The easier gear will also allow you to jump when you need to. Again, during the entire race it is important for the athlete to maintain efficient pedal technique as described earlier.

The final component of pedal technique is **Execution** – being **Relaxed** enough to apply correct pedal technique and cadence under extreme mental and physical situations. This is one of the reasons why world class athletes look so smooth. They are able to deliver on technique when it matters most. This is due in some part to the skill being second nature – practiced thousands of times over years and years. It is also due to the winner's mentality where every performance detail is scrutinized and developed. It's also the result of these athletes taking ownership for creating **Perfect Practices** and driving themselves to seek quality and concentration in every workout throughout their career. When the average rider does workout after workout without paying attention to detail...without taking technique seriously....without realizing that the little things matter....they fall further and further behind the elite performers.

This article to be continued.....

Please email me any feedback or comments you may have. Dan@elitewave.com