

# Power On!

The past couple of articles have touched on strength and power training. This article is going to discuss the concept of training with a power meter.

Recently, engineers have figured out how to measure the power output a cyclist is able to generate while riding a bicycle. I believe we will look back someday and realize what a revolution this really is. For the first time, in any sport that I am aware of, the power output of an athlete can be directly measured. Now this just isn't some technological marvel or a geeky toy (which it is), a power meter is a very powerful (pun intended) training and racing tool. I will attempt to mention some of the key reasons why this is so.

First, a little background. As I mentioned in previous articles, power is really the best measure of a cyclist's ability to ride fast. As a reminder,  $\text{work} = \text{force} \times \text{distance}$ , and  $\text{power} = \text{work}/\text{time}$ . So power is the ability to generate a force over a distance in a given amount of time. In other words, power is the ability to push oneself on a bicycle a given distance in a given amount of time. Power is what the cyclist (the power plant) generates to ride a bike at a given speed and is directly proportional to speed.

The reason power is such so useful is because it measures what happens to the bicycle, rather than what happens to the cyclist (e.g. heart rate). As we pedal a bike, a lot happens between the heart and the road. Heart rate is related to the amount of oxygen being used by the muscles, which is indirectly related to the amount of work muscles are doing. A lot of energy is lost through muscle inefficiencies, and energy transfer is lost in the shoes, pedals, cranks, chain, frame and wheels. The power that actually makes it to the road is what ultimately matters. So you can begin to see why measuring heart rate is very indirectly related to how fast your bike is going, whereas power measures the forces that actually make it through to the bike. Also, a number of variables impact heart rate, such as heat, humidity, fatigue level of the cyclist and natural person-to-person variability in heart rate. Now, I'm not trashing heart rate. It is still a valuable piece of information to have especially if you don't have a power meter, and even with a power meter, it provides some additional insight into what is happening during a training session or race. I'm just pointing out that power is superior to heart rate in determining actual output of the cyclist.

There are four main manufacturers of power meters. SRM is sort of the gold standard for power meters. It is supposedly the most accurate and it is also the most expensive. It measures the power generated within the crank axle in the bottom bracket. PowerTap has a power measuring device in the axle of the rear hub. Not only is this power meter more affordable than SRM, it also is more portable – the wheel can easily be moved from bike to bike. An SRM requires removing the bottom bracket to move it to a different bike. PowerTap also has the advantage of measuring power in the wheel rather than the crank, so the power is closer to the road. iBike makes a less expensive power meter that fits on the handlebars and measures power through the bike's speed, momentum and inertia. It appears to have fairly reliable results and is very portable from bike to bike. Polar also makes a power meter. It estimates power based on changes in chain tension. From what I've read, this lacks accuracy and is complicated to install. I'm sure as power meters become more popular the prices will continue to come down.

I believe the greatest value of training with a power meter is that you can now have an objective measure of the work you do, during an interval, during a training session, and over a period of weeks and months of training. Heart rate can only measure your effort. You can now compare your power output from various training sessions and know how hard you are working and can accurately determine if you are getting more powerful. You can quantify the amount of work you did in a workout, and add it up over a period of time. So now, instead of just measuring miles ridden, or hours trained, you can know how much actual work you have done. And over years, you can look back and directly compare if you have done more work this year than in previous years. The power meter is also a useful racing tool. Once you know what your sustainable power is, when you exceed that power level during a race, you know you are going anaerobic and it won't be sustainable, so a power meter can help you gauge your efforts and help determine your strategy.

In future articles I'll get into some of the neat things a power meter and its software can tell you about your training and racing.

To receive my cycling training newsletter, you can sign up for it on my website, [www.CyclesportCoaching.com](http://www.CyclesportCoaching.com) or click [here](#).

Ride on -- David Ertl

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