Heart rate monitoring remains a valid training tool

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As many of you will well know, heart rate monitoring is an excellent way of setting goals during both training and racing. Essentially, it provides an objective means of "pacing", and hence it is of particular importance to those individuals who lack the training and racing experience needed to have developed a keen sense of levels of perceived exertion (a subjective way of assessing effort).

You may read criticisms of the use of heart rate as a means of guiding training. Unfortunately, these criticisms are usually made by the producers and marketers of other, more complicated and more expensive ways of measuring effort, such as power meters for bicycles. Heart rate is by far, the most practical and accessible method of providing objective physiological feedback during any sustained physical effort, and in this article I address some of the criticisms of heart rate monitoring.

Physiological relevance of heart rate.

Physical effort depends upon oxygen delivery. In fact, life is dependent upon adequate oxygen delivery. As effort increases, so does the need for oxygen delivery to the various organs of the body that are required to function adequately and efficiently to permit that particular effort.

The determinants of oxygen delivery are very easy to understand. It depends upon the amount of oxygen contained within the blood that is being pumped to the various parts of the body, and the actual blood flow. Blood flow, or "cardiac output", is determined by the amount of blood pumped by the heart with each heart beat ("stroke volume"), and the number of heart beats per minute.

Or...

Oxygen delivery = oxygen content of blood x stroke volume x heart rate.

When we exercise, the necessary increase in oxygen delivery to our working muscles (and other organs) is achieved by increasing all three of these components, and hence, the measurement or monitoring of these variables could provide an objective guide as to the extent of effort we are performing.

During detailed exercise physiology tests, such as maximal exercise tests to determine maximal oxygen consumption, or $V(O_2)_{max}$, oxygen consumption is measured continuously. Oxygen consumption closely correlates with oxygen delivery and would be the perfect way of assessing the degree of effort, but it not practical to most of us who don't own their own portable (and waterproof) exercise physiology laboratory.

As you can imagine, monitoring the oxygen content of blood is not an easy task, and although the assessment of stroke volume can be made with some ease during clinically relevant diagnostic investigations, it is also not practical to the exercising athlete. Heart rate monitoring, however, is readily available and at a relatively minimal cost.

Responding to the critics of heart rate monitoring.

Other ways of assessing performance may focus on variables that are either non-physiological, or if physiological, do not reflect the state of the cardiovascular and respiratory systems. These range from the most obvious and simple, such as speed, to the more expensive, such as power meters for bicycles.

Power meters are that just that; devices for estimating the amount of power you are generating. They do not provide a measure of "effort" so to speak. They have their place, particularly in assessing the progress achieved in an athlete after a period of training, but cycling training programmes based solely upon power measurements may lead to overtraining.

I mention power meters here, because it is usually the manufacturers and distributors of power meters that publish the so-called drawbacks of heart rate monitoring.

One comment that is often made is that heart rate is very dependent upon factors such as ambient temperature conditions or hydration status and may be affected by recently performed strenuous training sessions. This is not a drawback of heart rate monitoring. In fact, this highlights the enormous value of heart rate monitoring. Heart rate reflects the amount of stress your cardiovascular system is under, as it compensates to maintain a level of oxygen delivery that suits your body's current demands.

Let's take a simple example of an athlete planning a training session according to heart rate training zones (an easy 2 hour cycle, at a heart rate of between 60% and 70% of their maximum heart rate). This athlete had failed to listen to his or her coach, and took it upon themselves to go for a hard run the evening before, and as a result of a poor night's sleep and failing to adequately rehydrate, they start their 2 hour cycle with a resting heart rate somewhat higher than would normally be expected. If that athlete were to remain disciplined by staying within that target heart rate zone (60-70% of HR_{max}), they would still place an amount of stress upon their cardio-respiratory system that is appropriate for that prescribed training session. They may not ride as fast, or produce as much power, but the cardiovascular benefits would remain.

Using this same example, a cycling session that prescribed strict power output targets would effectively lead to an over-training of that athlete on that day, putting them at risk of injury or illness (or worse still, poor competitive results).

As I mentioned above, power meters do have some role in the assessment of cyclists and the programming of their training sessions, and therefore I do not discount their value, especially as cycling performance, more so than running or swimming, does depend a fair amount upon activity-specific muscular strength.

Setting target heart rate zones.

The simplest way of using heart rate monitoring for training, is to set target zones according to your individual maximum heart rate. Maximum heart rate does not change with your level of fitness, and, as a rule, tends to decrease as you get older. Most if us, however, do not actually know our own maximum heart rate, as this requires a sports-specific maximal exercise test, and end up using an estimate of our maximum heart rate based on population data.

Another approach, and one that makes much more sense, is to set targets based upon the difference between your resting and maximum heart rate. As stated above, maximum heart rate does not change with fitness level, but resting heart rate does. As a result, your heart rate zones change as your levels of fitness increases (or decrease, whatever the case may be).

Another figure often used to establish heart rate training zones is an athlete's anaerobic threshold (which is similar, but not identical, to ventilator threshold, or lactic threshold). These are terms that you may have read about, but once again, they require detailed and expensive physiological testing (sometimes with concurrent blood sampling) to calculate. They are of particular use to coaches and athletes, because they are "trainable" parameters, and therefore, basing target heart rate training zones around these values are more relevant at any particular stage of an athlete's training, because they are based upon a value that is specific to *that particular athlete, at that particular time*.

Feel free to e-mail me any questions you might have, or any of your own thoughts, opinions and experiences, and don't forget to ask you coach for assistance when deciding how best to monitor your effort during training.