Real time ‘physiological’ monitoring tools

© by IAAF
23:3; 131-133, 2008

Introduction

The pursuit of remote physiological monitoring as an approach to reduce hospital based health care costs has been gaining ground in the past five years. The basic concept of this approach is to develop small, lightweight and robust devices that can be permanently worn by patients to provide a continuous method of tracking and monitoring various life signs measurements, e.g. heart rate, ECG, breathing rates. These devices have been built to provide continuous updates of information through wireless computer networks. In any instance where certain measures divert from the normal or healthy zones, the changes can be detected by the computer software, which then alerts the relevant users and allows for immediate intervention.

These technological developments have begun to lead to a proliferation of related products for the fitness and elite sports industries. This article will talk through one exemplar to provide an idea of the functionality and its potential application to track and field events as a means of effective training stress and recovery monitoring.

Current physiological measurement tools

There are already a number of simple commercial devices available to coaches to provide various instantaneous measures of physiological response to inform aspects of the training process during or after sessions, from acute or chronic training exposures. These include heart rate monitoring (www.polar.fi; www.suunto.com), blood lactate monitoring (http://www.lactatepro.com.au) or measures of core and skin temperature (www.minimitter.com; www.hqinc.net). In addition, custom tools have been developed to help provide more automated feedback and interpretations on an individual ‘training state’ from heart rate measures e.g. www.firstbeattechnologies.com, or on the basis of a collection of non-invasive measures e.g. www.omegawave.com.

However, with the ever-growing miniaturisation of electronics, the appeal of a single packaged device that provides feedback on a host of physiological measures, is increasing. The clear advantage in the development of these tools lies in the ability to develop a ‘video recording’ of an individual’s physiological state in and out of training and competition, rather than the traditional ‘snap shot’ that has been the premise of the majority of applied science in the past decade. Inevitably, this generates much more data to be managed but it has the advantage of providing a greater understanding of the day-to-day variation and a useful indicator of when a training intervention has altered an athlete’s physiological state.

An exemplar: ZephyrTech and coaching

To provide an insight into the type of functionality now becoming more readily available, we have focused on a commercial device that is available to use today. The Zephyr Biohar-

Figure 1: The Zephyr Bioharness™

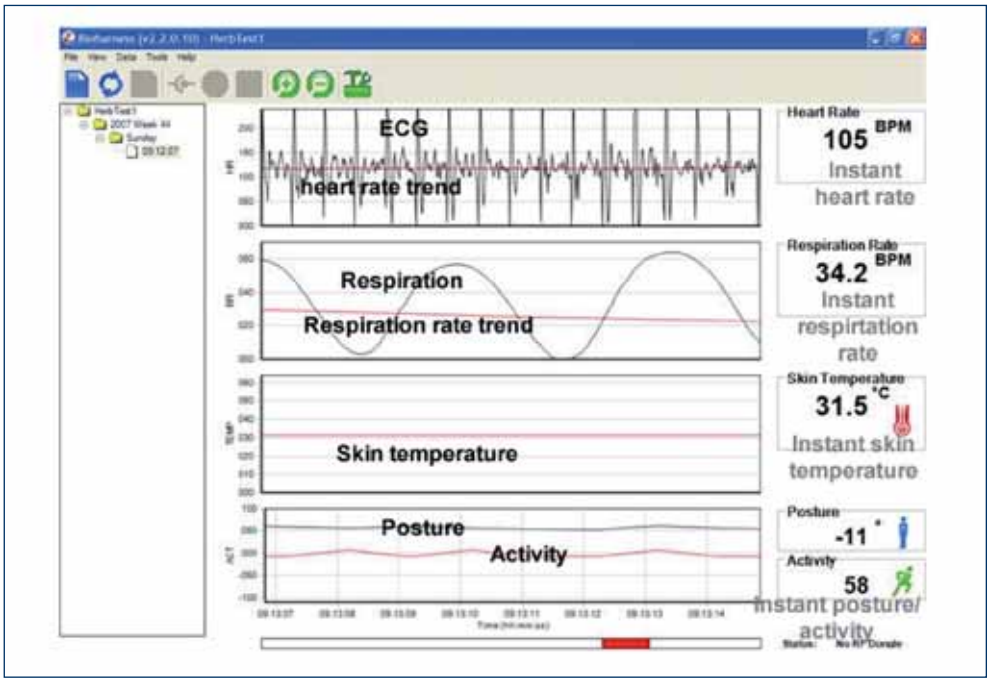

Figure 2: A screenshot form the Zephyr BioharnessTM software

ness™ (www.zephyrtech.co.nz) uses patented Smart Fabric sensor technology in a garment that is comfortable and unobtrusive. The device provides significant functionality and allows a coach to:

- Monitor up to 64 subjects simultaneously in real time
- Receive real-time and off-line analysis
- View comparative, real time and trend analysis via graphical display analysis
- Monitor heart rate, R-R, breathing rate and depth
- Monitor IR skin temperature measurements
- Monitor activity and posture measurement via 3D accelerometer
- Use in-built wireless connectivity to at least 150 meters Monitor heart rate, R-R interval and ECG trace
- Measure in velocity magnitude units over pre-defined epochs for calorific analysis and METS.

So what can this device offer in a practical sense above and beyond other coaching tools used to inform the training process? This is best illustrated through some questions posed to an experieced coach who has used the device.

Why did you choose to go this route as part of your coaching?

A few of our athletes (runners) wanted to use the BioHarness in the field to do some specifc Ventilatory Threshold training. They came into the lab to have a VO_2max test using lab equipment and also wearing the BioHarness. We set specific guidelines on training and pacing based on the lab results that they could take onto the track using the BioHarness. They all did a six-week block where they were able to recover faster (as recovery intensity/off days were specifically monitored to be true recovery), and were able to hit the true intensity of intervals to maximise training. The payoff was significant - they are now dominating their area cross country races.

What did you find useful about the device?

Functions found useful: logging and uploading to monitor training, combined with

Figure 3: A team system in ‘action’

specific workouts meant that the athletes again could really maximise return from training. One of the guys suffered from exercise induced asthma (EIS) and we were able to control the onset by setting specific breathing and intensity rates in his warm-up. Being able to watch HR and BR in real time was essential to control the EIA. He now has a specific plan to avoid onset.

Have you had any adherence issues with the use of the device?

We have had no real problems. The athletes loved using BioHarness and wanted to keep using it because they loved the real-time specific feedback that was non-lab based and non-invasive (i.e. no need for finger sticks to monitor lactate for threshold work as they could use breathing rate, HR against VT.)

A word of warning

Before you decide to apply and use some of the interpretations it is essential you review the scientific logic, rationale and evidence supporting the claims from any physiological measurement tools. Understand any algorithms built into the software so you are clear how interpretations are obtained from the numbers presented and spend time understanding the interpretations in relation to the individual(s) you coach. Many software tools that provide interpretations on data will have some variability and it is therefore essential to spend time learning about the context of the training plan and what the automated responses report.

Please note: the author has no commercial involvement with any of the companies or products discussed in this article

Reported by Scott Drawer, PhD
Research & Innovation Unit
Performance, UK Sport
scott.drawer@uksport.gov.uk