Monitoring Athlete Workload: Combining Sensor Technologies in Field Team Sports

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ABSTRACT

The pressure on athletes to perform increases with the level of competition and thus great interest is placed on the monitoring of athlete workload. Technology used at the elite level in team sport is as diverse as the sports themselves, ranging from video analysis of competition to laboratory based strength tests. Sensor technologies are steadily working their way into elite competition as they provide information on athletes usually without inhibiting athlete performance during training and competition. The analysis of recorded athlete data is often limited by user understanding, interpretation and data volume. Very few studies have explored the common technologies in field based team sports and how these technologies can be combined to provide further information towards monitoring workload.

Historically, many sporting codes have been opposed to the use of technology at the elite level. In a general sense, the community perception of technology in sports is shifting with many sports now permitting the use of sensors to monitor workload in competition [1, 2]. Two of the more common technologies in field based team sports, Global Positioning Systems (GPS) and Inertial Motion Units (IMU) are frequently becoming common at the elite level. With continuing advancements in technology, these devices are often being incorporated into single, athlete mounted units, however, the information they provide is often not being utilized to its full potential. This research proposes a method to improve workload monitoring by combining data provided by both GPS and IMU devices.

Global positioning data is typically comprised of a series of latitude and longitudinal samples calculated after triangulation from multiple visible satellites. By combining this data with time stamps for each sample, fundamental workload indicators including distance, speed and acceleration
can be extracted. Neville et al [3] has developed further analysis techniques for processing GPS data to identify longitudinal workload analysis techniques including methods for monitoring fatigue and injury recovery. GPS devices are however limited by their required satellite connections as well as being limited to tracking activities where over-ground displacement can be determined. Previous research [4] has also discovered that GPS suffer from reduced accuracy during dynamic activities. By exploring the application of IMU devices, these limitations of GPS can potentially be reduced.

Inertial motion units (accelerometers, gyroscopes and magnetometers) provide information on athlete bearing, body rotations and impact forces, each of which can aid in monitoring athlete workloads. Unlike GPS, IMUs provide a more abstract method for monitoring physical limb or center of mass movements. Previous research [5] has explored the use of accelerometer force measurements for tracking athlete collision counts, and bouts of high intensity. On-going research [6] with accelerometer devices is exploring the possibility of extracting speed from elite level competition accelerometer data with promising results. These advancements in IMU data analysis methodologies create a baseline to expand on workload management tools by utilize both technologies.

GPS and IMU devices provide very unique perspectives on athlete workload monitoring. By combining both sensor platforms and their analysis techniques, the limitations of one sensor can be minimized using the strengths of the other, thus leading to increased accuracy of the collected data and improved methods for monitoring athlete workload.

REFERENCES


