

## **Wheelchair Sport: Pushing from Atlanta to Rio – the Sports Science Journey.**

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### **ABSTRACT**

In order to develop and implement safe and effective training programmes for a wheelchair athlete an understanding of the physical impairment is essential. This article will focus on the wheelchair athlete to describe how the training prescription for the nondisabled may be challenged in terms of its use for athletes with a spinal cord injury (SCI); describe the approach taken to optimise wheelchair set-up and finally describe how a multi-disciplinary sports science team prepares athletes for competition in the heat.

Wheelchair sports involves a repetitive cyclic movement pattern which may be considered similar to that of cycling, running, or swimming, yet the training principles are not directly transferrable. The wheelchair athlete uses a considerably smaller amount of muscle mass which is dependent upon their disability and/or functional capacity. For wheelchair athletes, who regularly take part in competitive sports this intriguing complex model continues with noticeable hypertrophy in the upper extremities and muscle atrophy below the level of the lesion (Sutton et al., 2009). That said, regardless of physical impairment, from a physical foundation, it is imperative to develop and/or maintain the components of fitness, and there is strong evidence to suggest that wheelchair athletes gain similar training adaptations to the nondisabled through aerobic and anaerobic conditioning (Janssen & Hopman, 2005). It is important to note that the heart rate (HR) may be affected for some SCI participants because of the attenuated HR response due to the impairment of the autonomic nervous system (Janssen & Hopman, 2005). It may therefore be that individual ratings of perceived exertion (RPE) may be an important tool for monitoring and regulating training intensities in SCI populations. In accordance with the recommendation that the use of daily training based on HR is not encouraged for all persons with a SCI, recent work published by Goosey-Tolfrey et al., (2010) and Paulson et al., (2013) has shown encouraging potential for the use of RPE to self-regulate exercise intensity in wheelchair athletes with a SCI. However, the conclusions derived from these studies must be interpreted with caution since both studies involved persons whom were highly trained and familiar with the use of RPE.

Configuring a sports wheelchair is a multifaceted task, with so many individual components that can affect performance in a variety of ways (Mason et al. 2013). When working with wheelchair athletes it is evident that they are a relatively heterogeneous group who can differ widely in terms of physical capacity, owing to the severity of their impairment. Therefore, one configuration will not be optimal for all athletes. The sport and/or player's role on court also influences which performance aspect of the wheelchair is most crucial to a specific athlete. Obviously, the best way to optimise a wheelchair athlete's configuration is to test them on an individual case-by-case approach, this will be discussed.

Competing in hot environments presents many unique challenges to any athlete let alone a Paralympic athlete. The starting point for any programme of sport science support should be to review the risk categories of the sporting environment. Interestingly, from previous work via a 'needs analysis' has allowed the team to prioritise areas of support (Goosey-Tolfrey and Diaper, 2015). With on-court core temperatures of close to 40°C during wheelchair rugby scrimmages, it was felt that those athletes with a high SCI who typically display a reduced ability to control body temperature and inability to sweat below the level of injury had to review their cooling strategies. Several cooling methods which included hand cooling, ice vests and fans have been explored.

In summary, coaching Paralympic athletes employs the same underpinning training principles as for AB athletes with subtle but significant alterations. Coaches working with this cohort of athletes need to ensure that they are familiar with knowledge surrounding the

physiological consequences of a SCI. There are novel technological advances that have assisted athletes with the monitoring of their training intensities such as the use of HR monitors and huge advancements recently with chair design. However, it appears that we can still rely on subjective measure (e.g., RPE) in SCI athletic cohorts. It is always difficult to appreciate how the extent of this work described had on overall performance at the Paralympics. Yet, it is clear that evidence-based research is essential to drive forward the delivery of innovative support strategies when preparing our Paralympic athletes. There remains a lot to be learned and tools to be developed and to move forward we must collaborate and share our knowledge between both specialists in rehabilitation sciences and sports sciences.