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The Effect of Hyperbaric Oxygen Therapy on Modulation of Heart Rate Variability after Sub-maximal Cycling

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The use of mild hyperbaric oxygen therapy (HBO) by professional and amateur athletes for speed recovery is blooming in recent years (Figure 1). It can be devastating for professional athletes if they are unable to recover in time from exercise related fatigue, including the fatigue of the nervous system. This often means their sports performance and trainability are compromised. With this in mind, we are interested to examine the effect of mild HBO on the recovery of the autonomic nervous system and muscle power after moderate workload. This study can be achieved non-invasively by assessing heart rate variability (HRV), as some of the values closely resemble vagal activity (Task Force, 1996). Muscle activity, on the other hand, was assessed using surface electromyography (sEMG). Previous findings have reported that elevated HRV indices are associated with sound training performances (Garet et al., 2004), and other studies have shown a temporal increase in HRV during HBO treatments (Lund et al., 1999; 2000; 2003). If these findings are confirmed to be true, it can provide scientific evidence to support the current use of mild HBO therapy for speed recovery. Its use may improve the quality of training and enhance sport performance. Ten healthy and active males (28.3 ± 6.3 yrs) were recruited for this study. All subjects visited the laboratory on four separate days. Cycling VO2max and maximum aerobic power (WM, Watts) were determined via an incremental test on 1st visit to standardise the exercise intensity throughout the study. In the 2nd - 4th visit, subjects were randomly assigned to either: (1) 90 mins HBO at 1.27 ATA, 80% oxygen; (2) 50 mins HBO at 1.27 ATA, 80% oxygen plus 40 mins in normobaric normoxia (NNO); or (3) 90 mins in normobaric normoxia (Control) to create a single-blind study. Muscle Activity Surface EMG activity of vastus lateralis and vastus medialis was recorded continuously during the 6s pre/post cycling sprint and 30-minute cycling exercise. The maximal iEMG values for each muscle in the 6s post-sprint were expressed as a percentage of the corresponding values obtained from the 6s pre-sprint. Mean integrated EMG (mean iEMG) and mean power frequency (MPF, Hz) were calculated for the 30-minute cycling exercise. The subjects rested comfortably for 15 minutes in supine positions before each measurement was taken. Ventilation rate was paced at 15 cycles per minute (0.25 Hz) during the recordings. Seven minutes of supine recording was captured using a Polar RS800 heart rate monitor. Based on the recommendation of Task Force (1996), 5-minute HRV was examined in the time and frequency domains, and non-linearly using Poincaré plot analysis. Statistics A two-way ANOVA was used to evaluate the changes of power output and sEMG in the 6s sprints, and the HRV indices between each treatment. Multiple comparisons were made using Bonferroni post-hoc test. A significant difference was considered at the level of p-value < 0.05. Although mild HBO did not enhance post-submaximal anaerobic performance, the present study demonstrated that it had a beneficial effect on the recovery of HRV after sub-maximal cycling exercise. Fifty minutes of mild HBO can serve as a safe and practical mean for enhancing recovery of nervous system. It may worth to investigate whether the treatment has similar effects on athletes and under conditions when sympathovagal balance is significantly disturbed, such as post-maximal exercise and at altitude.