Change in muscle optical properties during prolonged bed-rest and subsequent rehabilitation in young subjects via a time domain NIRS tissue oximeter

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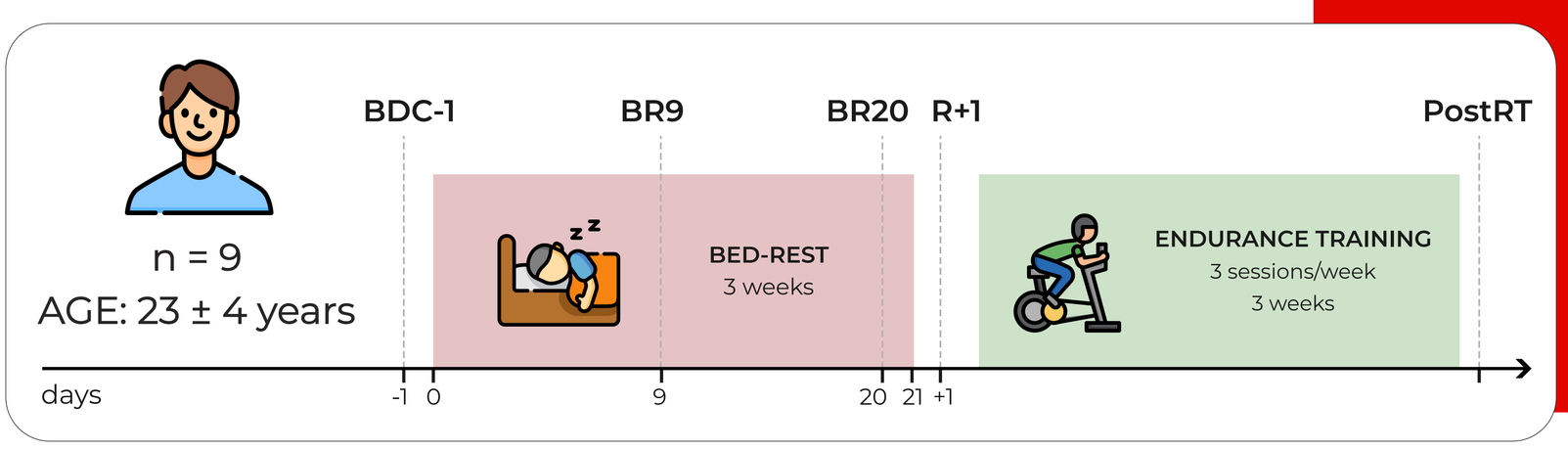
1. INTRODUCTION:

Time domain (TD) NIRS oximetry, providing direct estimation of absorbance (μ_a), and reduced scattering (μ'_s), is becoming a more reliable tool to track changes in the matching between oxygen delivery and utilization occurring within the muscle [1,2]. Prolonged muscle disuse, classically simulated by bed-rest studies, induces prominent changes in skeletal muscle structure, microvasculature and muscle oxidative capacity [3]. However, no longitudinal data are present to describe the effects of bed-rest on absolute optical characteristics of skeletal muscle. In this study TD-NIRS was used to monitor changes in muscle optical properties during prolonged bed-rest and subsequent rehabilitation in young subjects.

2. METHODS:



Quantitative Oximetry HHbMb, HbMbO2, HbMbtot, SmO2 @ different timepoints

Data (10-s duration, with an acquisition frequency of 10 Hz) were acquired with the NIRSBOX device (PIONIRS srl, Italy) at rest on the vastus medialis muscle of each subject in five consecutive sessions: pre-bed rest (BDC-1), after 9 days and after 20 days of bed rest, immediately post-bed rest, and post-rehabilitation. Statistical analysis was performed using one-way ANOVA for repeated measurement, with paired t-tests post-hoc comparison to identify significant differences (Holm-Bonferroni's corrected p-value < 0.05) between measurement points.

3. RESULTS:

The distribution of the average baseline values for each subject are presented as boxplots in Fig. 1: (A) DPF and (B) StO2. Statistical analysis results indicated significant increase in DPF and resting-state tissue StO2 values between pre-bed rest, 9 days, and 20 days of bed rest. Trends towards baseline conditions post-bed rest and after the retraining period have been recorded.

4. CONCLUSIONS:

The ability of TD-NIRS to provide quantitative and reproducible measurements allows for accurate comparisons in longitudinal studies, offering robust insights into the physiological changes occurring during bed rest and subsequent rehabilitation. Significant variations in DPF and StO2 observed in this study highlight the profound impact of prolonged bed rest on muscle physiology. Further investigations will be performed on potential correlation between NIRS data, ATT and BMI.

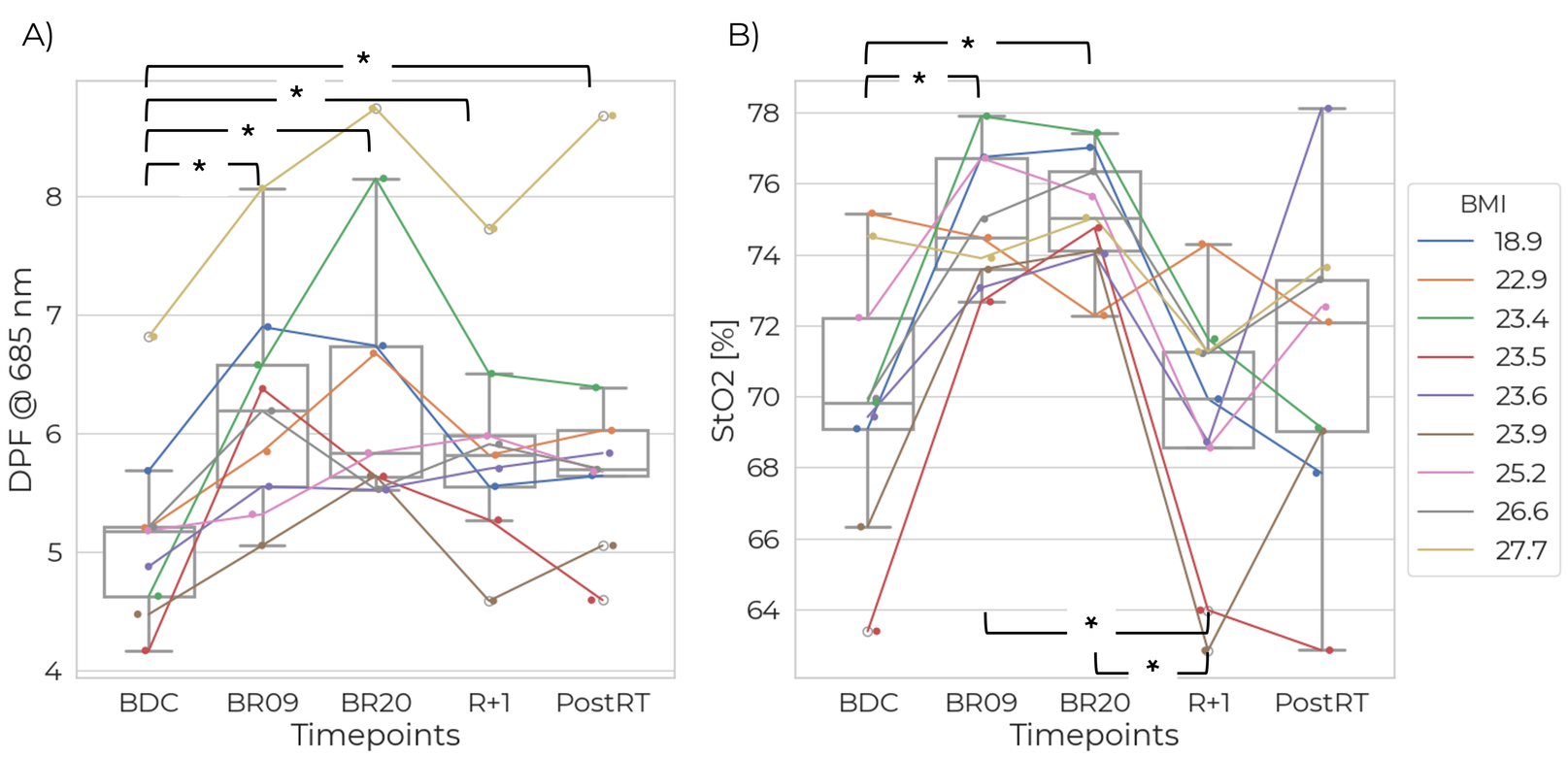


Fig. 1: Variation of (A) DPF @ 685 nm and (B) StO2 at different timepoints. Those marked with * show a significant variations (p-value < 0.05).

MORE INFO

5. REFERENCES:

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