



fNIRS Brain Imaging is Capable of Discerning Hemispheric Laterality During Lower-body Contractions

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INTRODUCTION

Use of functional near-infrared spectroscopy (fNIRS) to measure and image brain activity during movement is increasing. This technique uses near-infrared light to detect changes in oxygenation in the cortex which are associated with increased cortical activity. However, fNIRS is known to have lower spatial resolution than other brain imaging techniques. Due to its relatively low spatial resolution, it is unclear if fNIRS can discriminate between nearby areas of the motor cortex (M1). This capability is particularly important in studies requiring lower extremity contractions for 2 reasons: 1) the left and right leg areas of the motor cortex are in close proximity, with only the longitudinal fissure separating them, and 2) the cortical areas responsible for the most distal musculature descend inferiorly into the fissure, and are therefore deeper than most motor areas. **The purpose of this study was to determine fNIRS' ability to discern laterality of isolated unilateral lower body contractions.**

METHODS

Subjects:

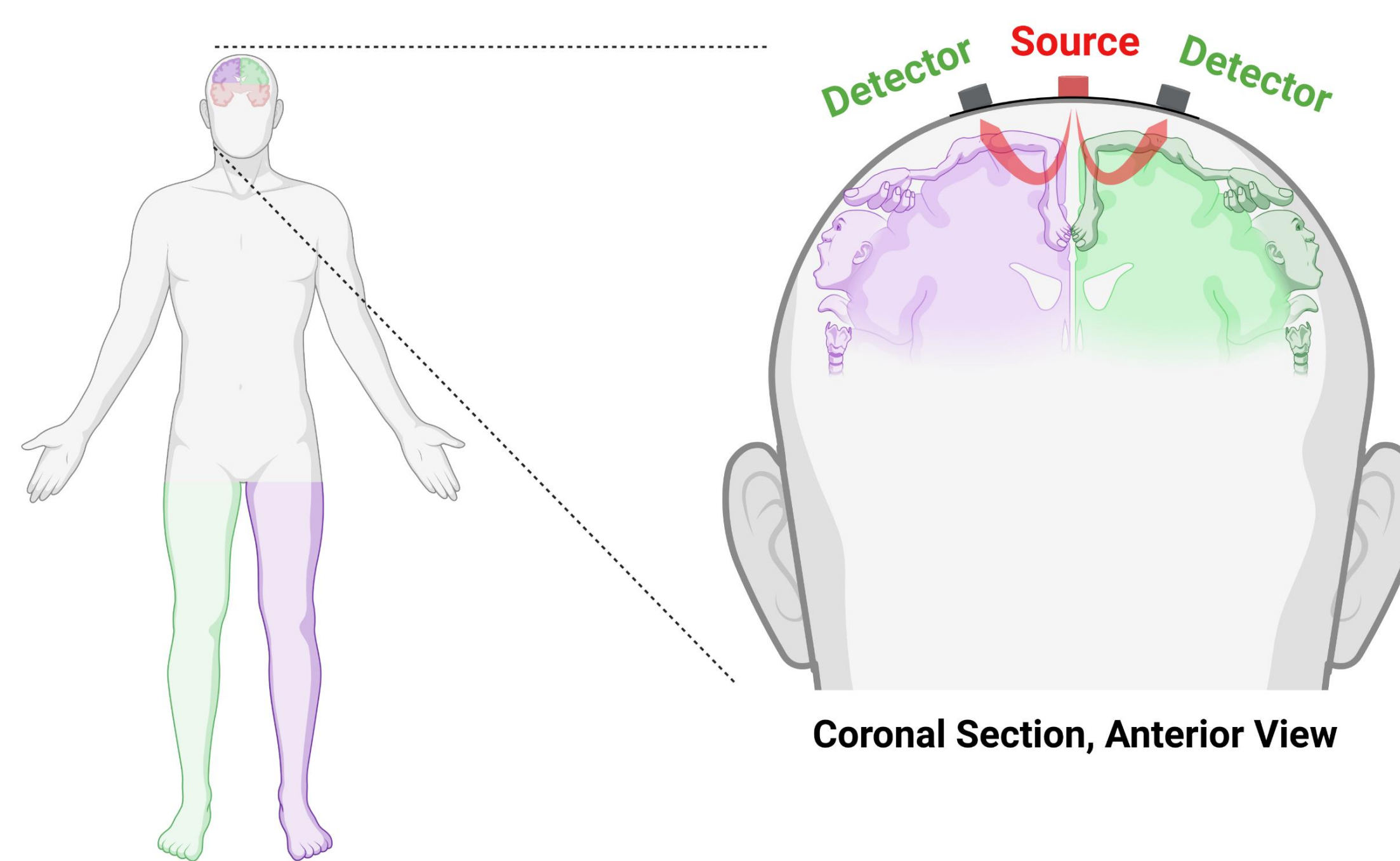
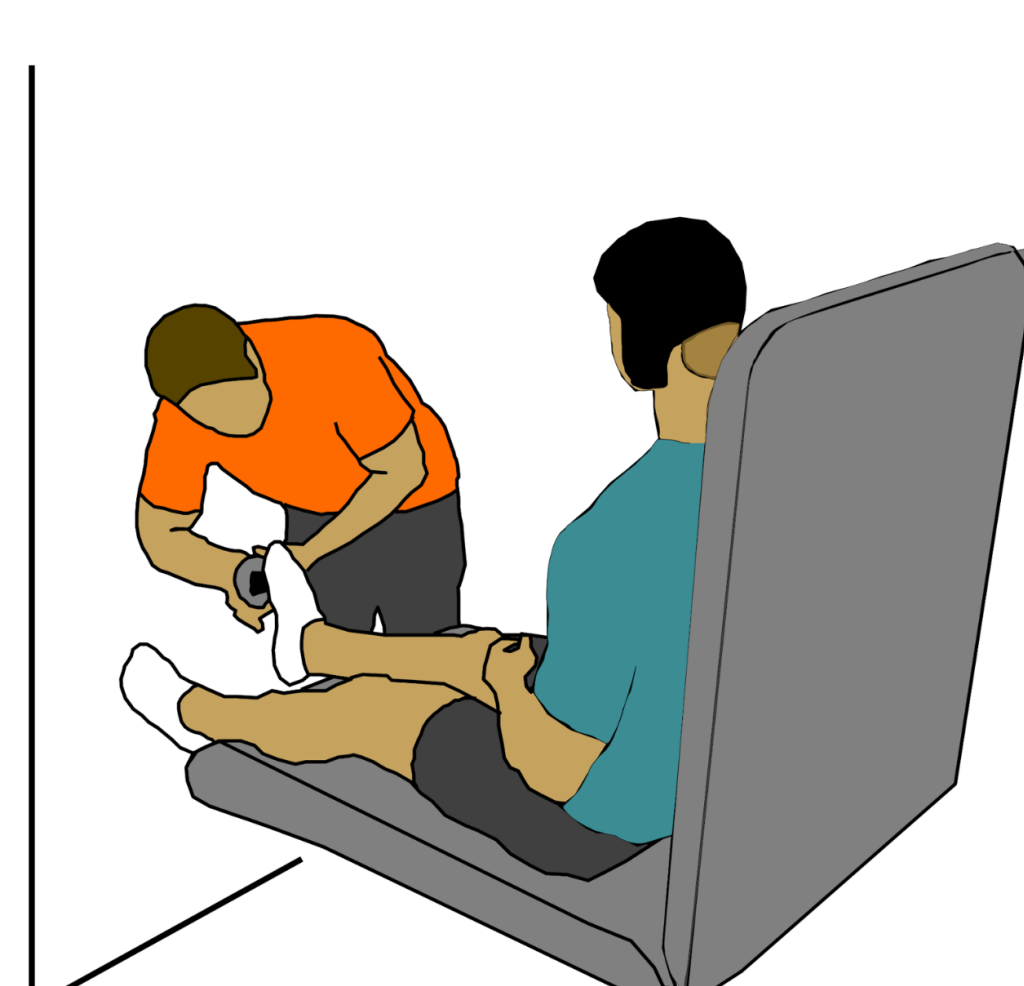
- 40 young, healthy individuals

Contractions:

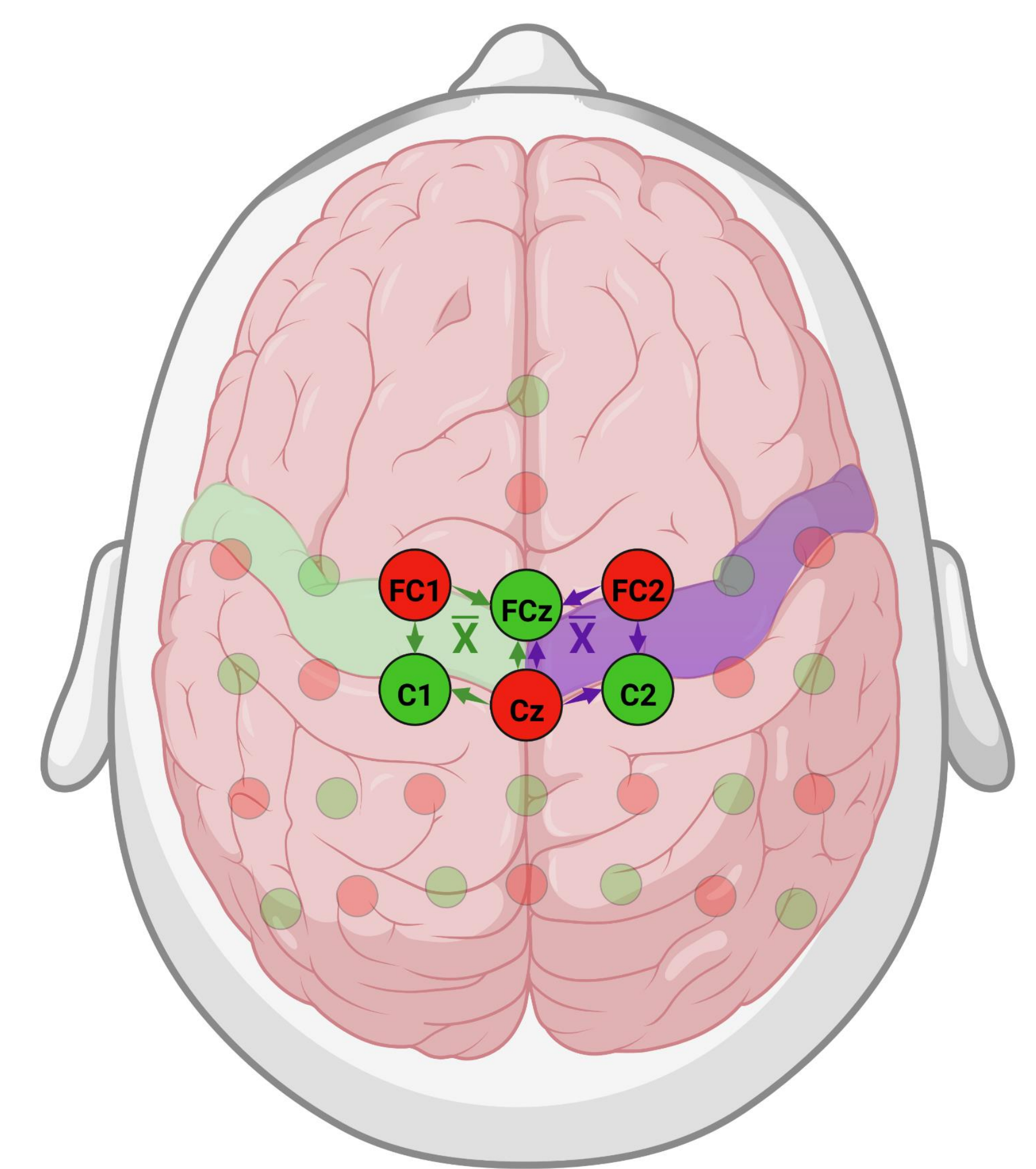
- ~30% of isometric maximum
- 15 second duration
- Left leg and right leg
 - Knee extension (a)
 - Knee flexion
 - Plantar flexion (b)
 - Dorsiflexion

A.) Knee Extension

B.) Ankle Plantarflexion



Coronal Section, Anterior View



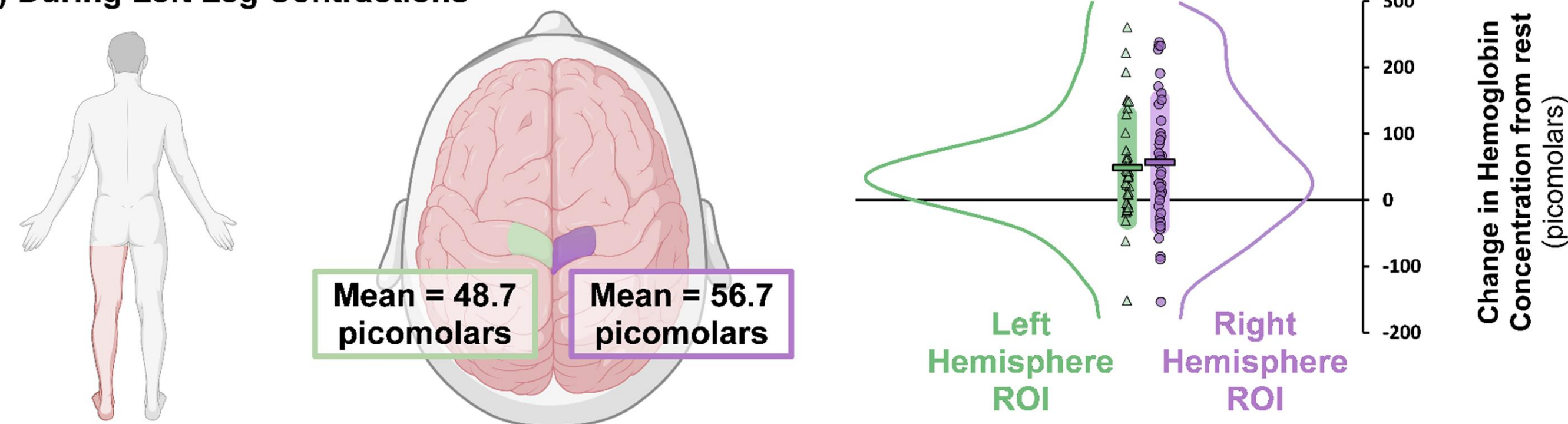
Superior View

fNIRS:

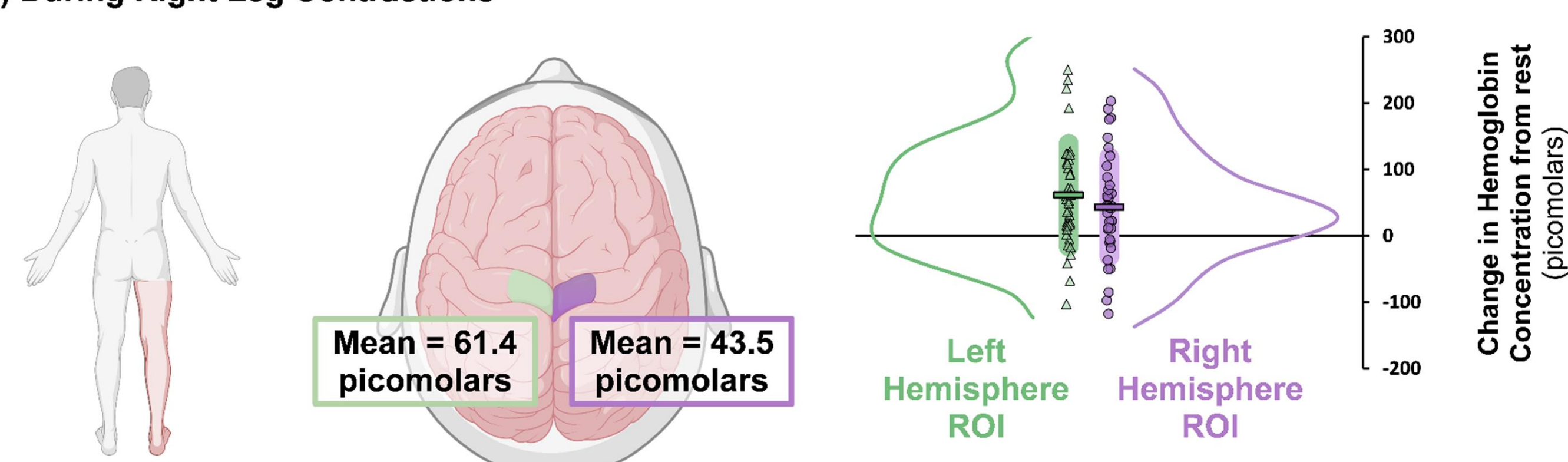
- Sensors over longitudinal fissure and central sulcus
- Four channels of data per hemisphere
- Blood oxygen response to contractions recorded
- Region of interest tolerance conditions

RESULTS

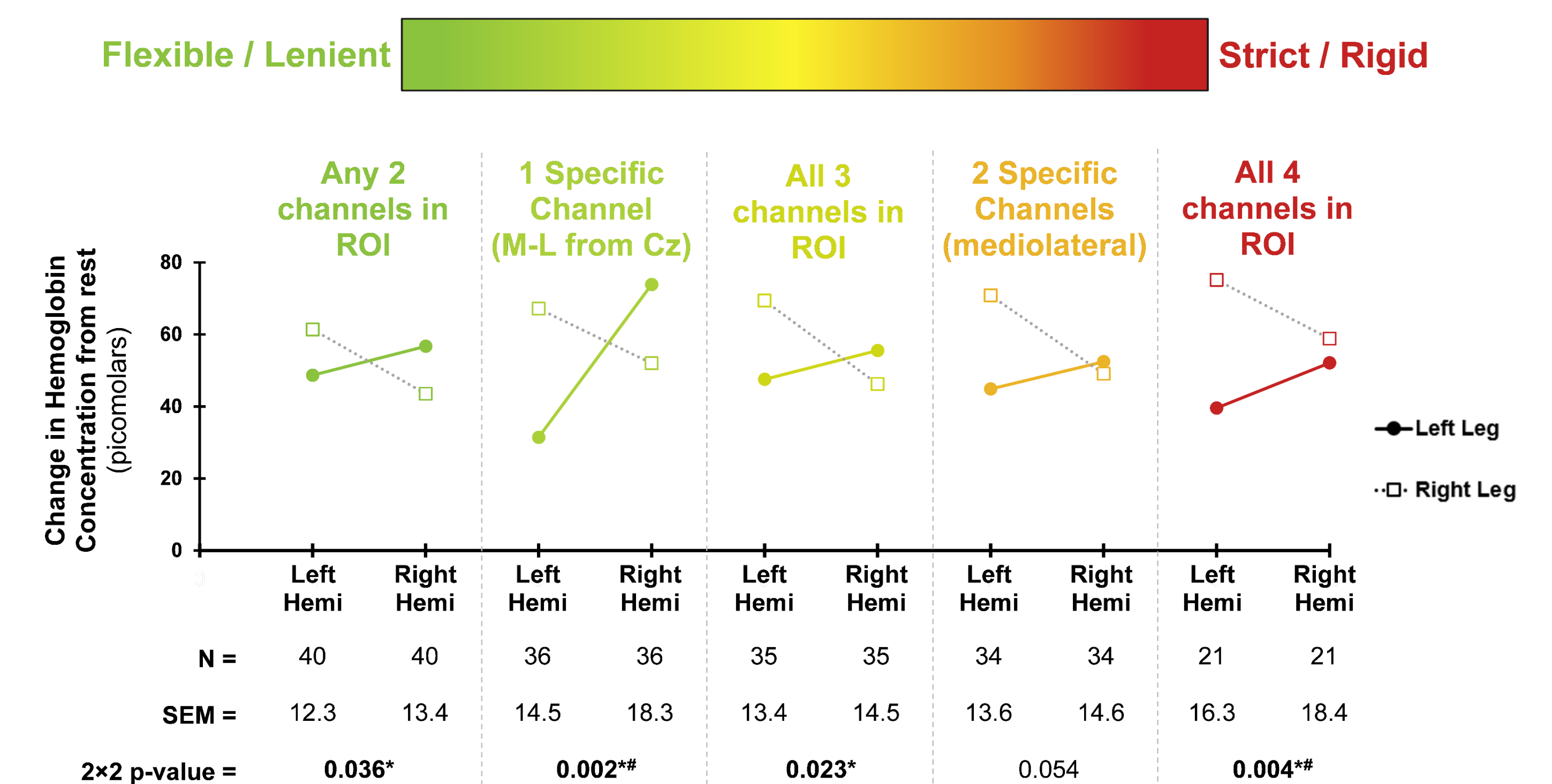
A.) During Left Leg Contractions



B.) During Right Leg Contractions



C.) Region of Interest (ROI) Tolerance



DISCUSSION

This study suggests that fNIRS is capable of discerning nearby areas of the motor cortex. Further, this technology has sufficient depth of penetration and spatial resolution to identify which cortical hemisphere is active during a unilateral lower body contraction.

