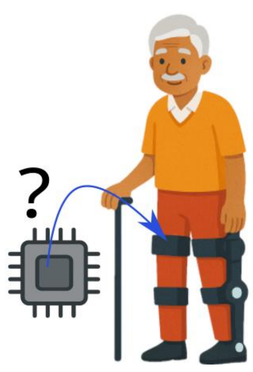
Preliminary Results on the Integration of Muscle Oximetry Sensors for Exoskeleton Interfaces

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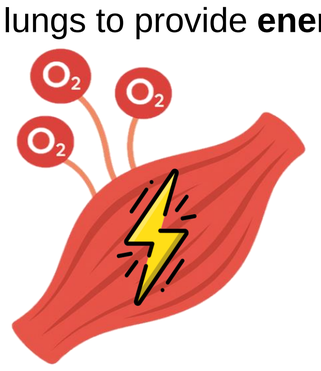
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Introduction

Lack of integrated muscle oximetry inside exoskeleton attachment



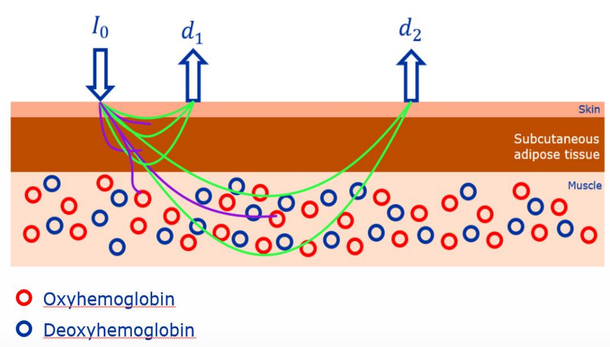
Muscle uses **oxygen** from the lungs to provide **energy**

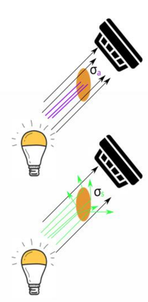


Depletion of oxygen might indicate onset of **muscle fatigue**



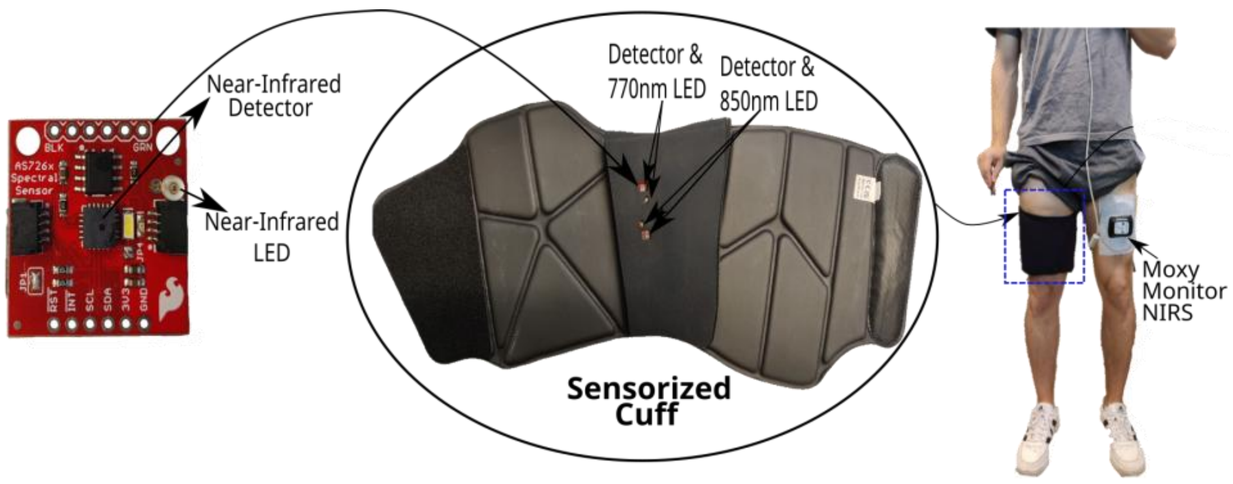
Near-Infrared spectroscopy to monitor oxygenated blood



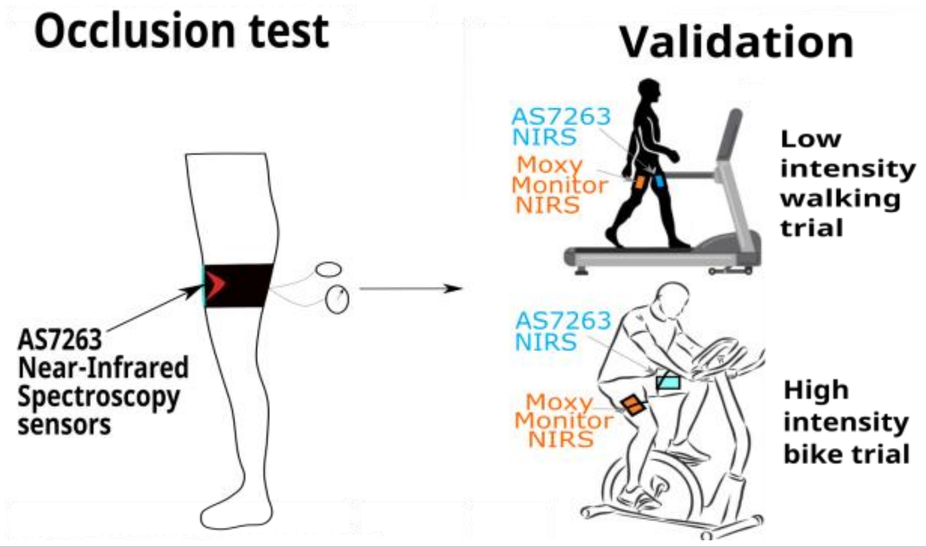


Methods

NIRS integration inside exoskeleton cuff



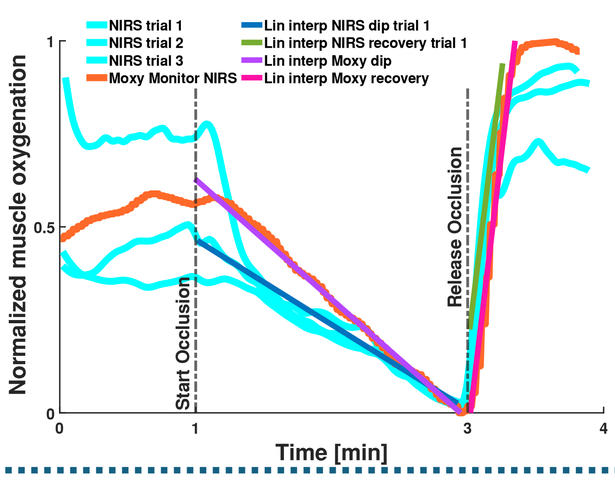
Compare custom vs gold standard muscle oximeter

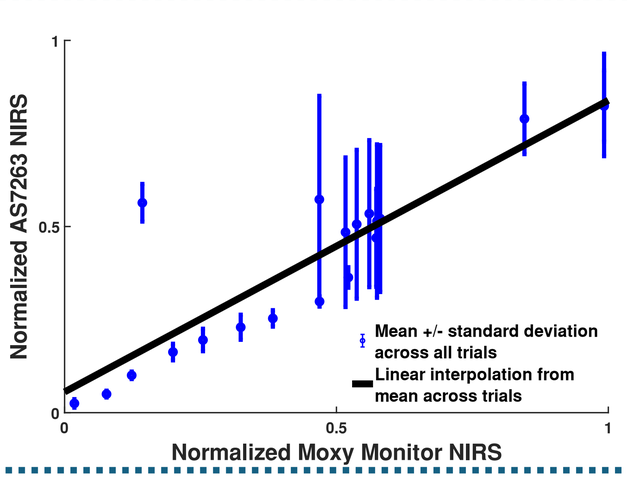


Results

Occlusion

During occlusion**, oxygen saturation dropped sharply** and **rebounded rapidly upon release**, closely matching Moxy readings and confirming the sensor's ability to detect ischemic events and hyperemia.

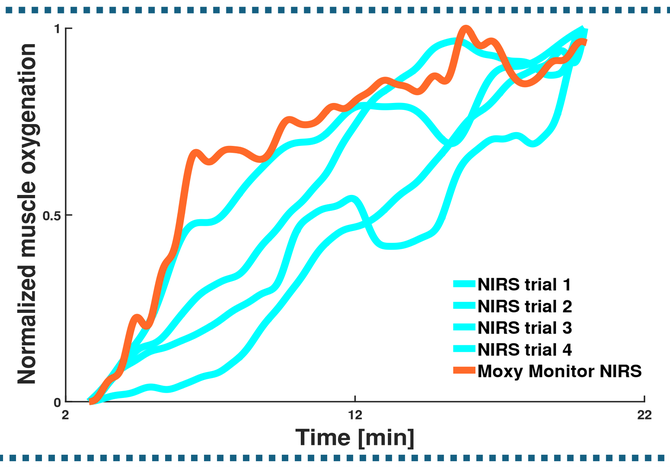


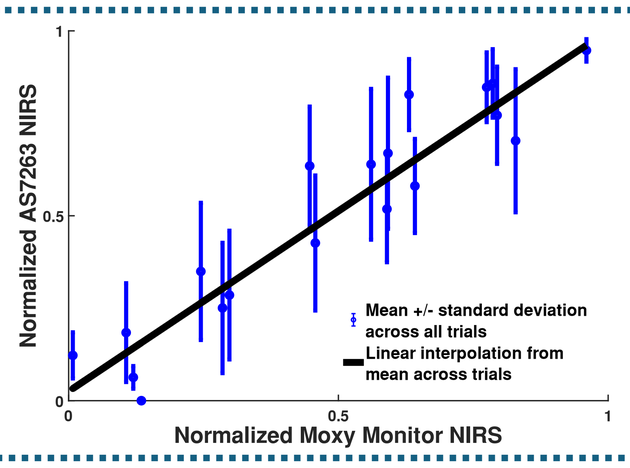


R^2 = 79%
RMSE = 11%

Walking

Over 20 minutes of low-intensity walking, **saturation gradually increased in strong alignment with Moxy data**, reflecting adequate oxygen delivery and highlighting the sensor's sensitivity to mild exertion.

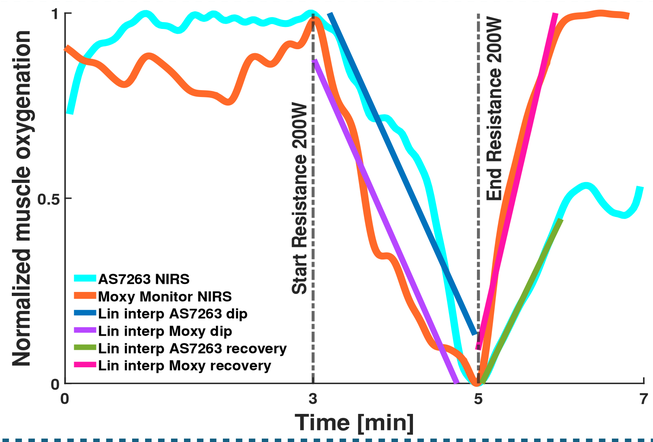


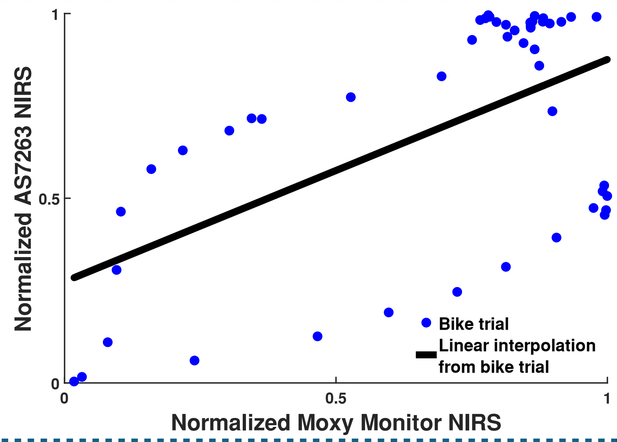


R^2 = 89%
RMSE = 9%

Cycling

High-resistance cycling caused a **marked drop in saturation, indicating increased metabolic demand**; although some **motion artifacts reduced correlation**, the sensor consistently captured the overall depletion and recovery pattern.





R^2 = 33%
RMSE = 27%

Conclusions & Future works

This study integrated a compact NIRS sensor into an exoskeleton cuff and showed it accurately tracks muscle oxygenation during occlusion, walking, and cycling, closely matching a commercial device. Future work will enhance dynamic accuracy, validate across broader users, and employ real-time oxygenation data for closed-loop exoskeleton control.

About RevalExo Project

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