The Relationship between Pain Sensitivity and Motor Adaptations
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Introduction
The perception of pain in patient populations can arise from tissue damage but when pain persists past the point of tissue healing it is thought to relate to abnormal pain processing in the CNS such as persistent central sensitization. Studies have shown that persistent central sensitization occurs in about 1/3 of people with chronic pain from knee OA and this abnormal pain processing can affect motor output and motor adaptation. It is unclear whether individuals with OA and persistent sensitization are predisposed to heightened pain perception or whether they develop heightened pain as a result of the chronic pain from OA. The purpose of this study is to determine the influence of heightened pain sensitivity on motor output and motor adaptation. We designed this study to determine the relationships between central sensitization (temporal summation and conditioned pain modulation) and motor output and adaptations that are measured by the “broken escalator phenomenon”. This poster outlines the preliminary work associated with the design of this study.

Protocol Development
- Assessment of Methodologies
- Literature review
- Pilot Testing

Treadmill Set Up Broken Escalator Paradigm
- Sled used by Reynolds et al. (Fig. 1)
- Treadmill adapted to replicate the sled (Fig. 2)
  - Added a starting and landing platform

Treadmill Speed
- Previous studies
- Speed reduced to 0.71 m/s
- Speed of moving walkways in airports

Treadmill Positioning in Lab
- Control panel of treadmill obscured markers
- Initially positioned treadmill perpendicular to walkway
- Positions of cameras were not optimal for marker identification
- Removed treadmill control panel & placed treadmill parallel to walkway

Pain Pressure Testing
- Quantitative sensory testing to measure pain pressure threshold in subjects
  - Use a pressure algometer (Algometer Commander JTECH Medical, Midvale, Utah)
  - Rate of pressure was at 30N/sec
  - Stopped testing when subject perceived the stimulus as painful

Conditioned Pain Modulation
- Conditioned pain modulation involves the application of a painful “conditioning stimulus” that elicits a response in the nervous system that increases the pain threshold of a test-stimulus.
  - Test Stimulus: Pain pressure threshold (Fig. 5)
  - Conditioning stimulus: Ice bath

Temporal Summation
- Used an ice bath
- Level of pain was based off the Verbal Rating Scale (VRS) (Fig. 6)
  - 0 = no pain, 10 = worst pain imaginable
  - every 10 seconds for 1 minute

Self-Reported Pain Questionnaires
- Highly Sensitive Person Scale
- 27 Questions
- identify an individual’s level of sensory sensitivity relating to environmental stressors
- Sensory Processing Quotient (SPQ)
- 92 questions
- Measures hypersensitivity to various environmental stressors.

Data Analysis
- Regression analysis will be used to determine if pain sensitivity predicts motor responses

References:

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Participants
- Recruit participants from the undergraduate and graduate programs at the University of New England
- Inclusion criteria: between the ages of 18-30, currently a student and in good health with no comorbidities or history of mental illness
- Sign an Informed Consent Form that will provide all the information to what the study aims are

Procedures
- Pressure will be applied slowly by the algometer and the participant will be asked to state when the sensation changes from pressure to pain
- Temporal summation of pain will be assessed by submerging the participant’s hand in an ice bath for one minute while reporting their level of pain on the VRS
- 3D joint kinematics and EMG data will be collected using an 8-camera 3D motion analysis system (Qualysys, Gothenburg, Sweden) and wireless EMG system (TeleMyo 2400) (TeleMyo 2400 Telemetry Electromyography System (Noraxon, Scottsdale, Arizona)
- Surface electrodes over: biceps femoris, rectus femoris, gastrocnemius, soleus and tibialis anterior bilaterally
- Broken Escalator Trials:
  - First 20 trials: Stationary treadmill (BEFORE condition)
  - Middle 20 trials: Moving treadmill (MOVING condition)
  - Last 20 trials: Stationary treadmill (AFTER condition)

Data Processing
- Amount of temporal summation
  - Area under the curve in Fig. 6
  - 1st Response to moving trial
    - Circled in Fig. 7
  - Rate of adaptation during moving trials
    - Area under curves in Fig. 7

Figure 1
Figure 2
Figure 3 Camera views with walkway shown in yellow
Figure 4
Figure 5
Figure 6
Figure 7