Obstacle Avoidance Training Using Fully Immersive Virtual Reality

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Motivation

- At least **36 million** falls occur within the elderly population each year resulting in at least 32,000 deaths.

- Many of these falls are due to an **improper shift of balance or trip**.

- Clinicians have created **obstacle avoidance trainings and tests** to help elderly individuals to deal with obstacles in their path.

- The current standard for obstacle avoidance training is by using a treadmill. Which **limits the subject to walking without a walking aid and walking in a straight line.**

Objectives

- Create a **fully immersive** virtual reality obstacle avoidance exercise
- Be able to quantify improvements in **gait velocity, gait variance and step optimization**
- Obstacles must be maneuverable and changeable to allow for **maximum flexibility**

Methods

- Using Unity 3D to create the virtual obstacle course

- Subjects will wear the **VR headset and VR trackers on their feet**

- Subjects would walk along an instrumented mat for **8 laps** and step over the obstacles

- The Parameters that are being quantified and analyzed for changes are;
  - **Gait Velocity**
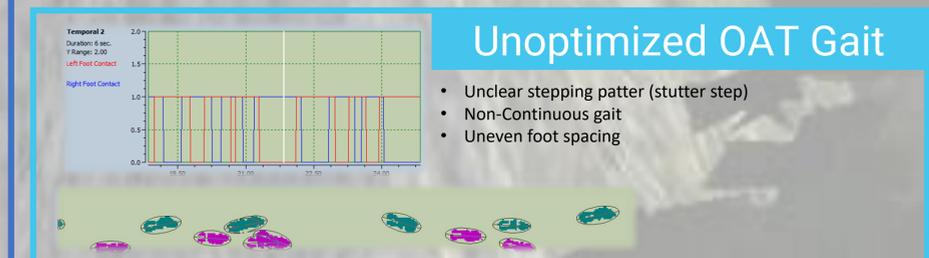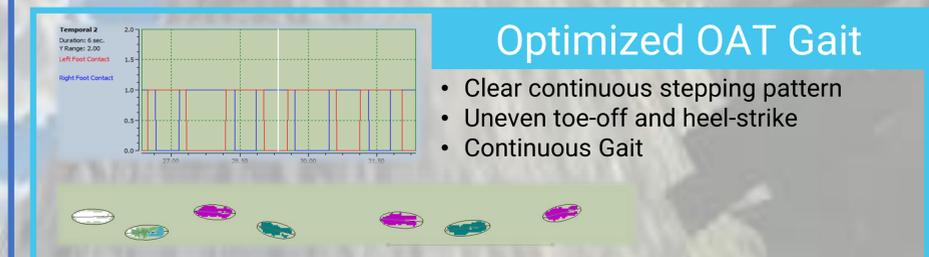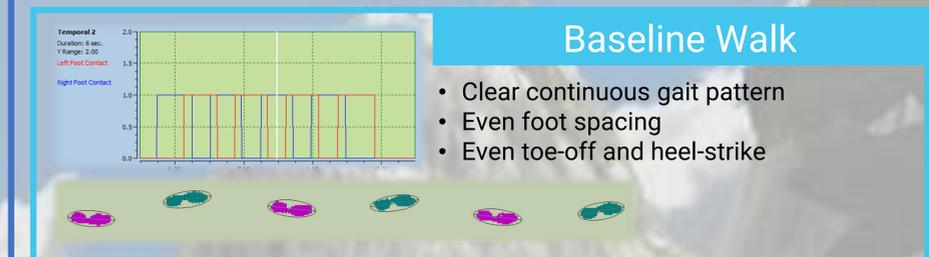 - **Gait Variance**
  - **Height Clearance**

Balance and Mobility Tests → Timed Up and GO Test → Baseline Walk 2 Laps → Obstacle Walk 8 Laps

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Results

Baseline Walk
- Clear continuous gait pattern
- Even foot spacing
- Even toe-off and heel-strike

Optimized OAT Gait
- Clear continuous stepping pattern
- Uneven toe-off and heel-strike
- Continuous Gait

Unoptimized OAT Gait
- Unclear stepping patter (stutter step)
- Non-Continuous gait
- Uneven foot spacing

Velocity (cm/s)

Foot Tracker Data

Conclusion-Future Work

- Fully immersive Virtual Reality, when paired with the trackers, **can be used successfully** for obstacle avoidance training
- Trackers can be used to **quantify improvements and optimization** in subjects walking patterns
- Use the **flexibility of design** for elderly subjects, subjects with walking aids or subjects with Parkinson's Disease
- Test effectiveness of training where the **subject must turn around curves or walk in any direction**