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Underwater Treadmill Exercise in Adults with Osteoarthritis

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Faculty Mentor - Dr. Eadric Bressel

Objective

To quantify the efficacy of a six-week aquatic treadmill exercise program on measures of pain, balance, mobility, and muscle thickness in patients with osteoarthritis (OA).

Background

Although no gold standards of exercise exist for treatment of Osteoarthritis (OA), there is the contention that OA patients who are unable to perform exercises on land, due to load-elicited pain and poor balance, should begin exercise therapy in an aquatic environment. The research on aquatic exercise generally suggests that there are some short-term benefits for reducing symptoms of OA, including joint pain reduction and improved mobility (1). A limitation of most previous aquatic exercise interventions for patients with OA was that exercises were performed in a shallow pool with minimal control over exercise intensity (1, 3). Aquatic treadmill exercise is the only form of aquatic exercise that allows for a high level of control over intensity, where water depth, current flow rate, and belt speed can be adjusted to produce equivalent energy demands between aquatic and land treadmill exercise (2, 3, 4).



Figure 1- Underwater treadmill interval training.

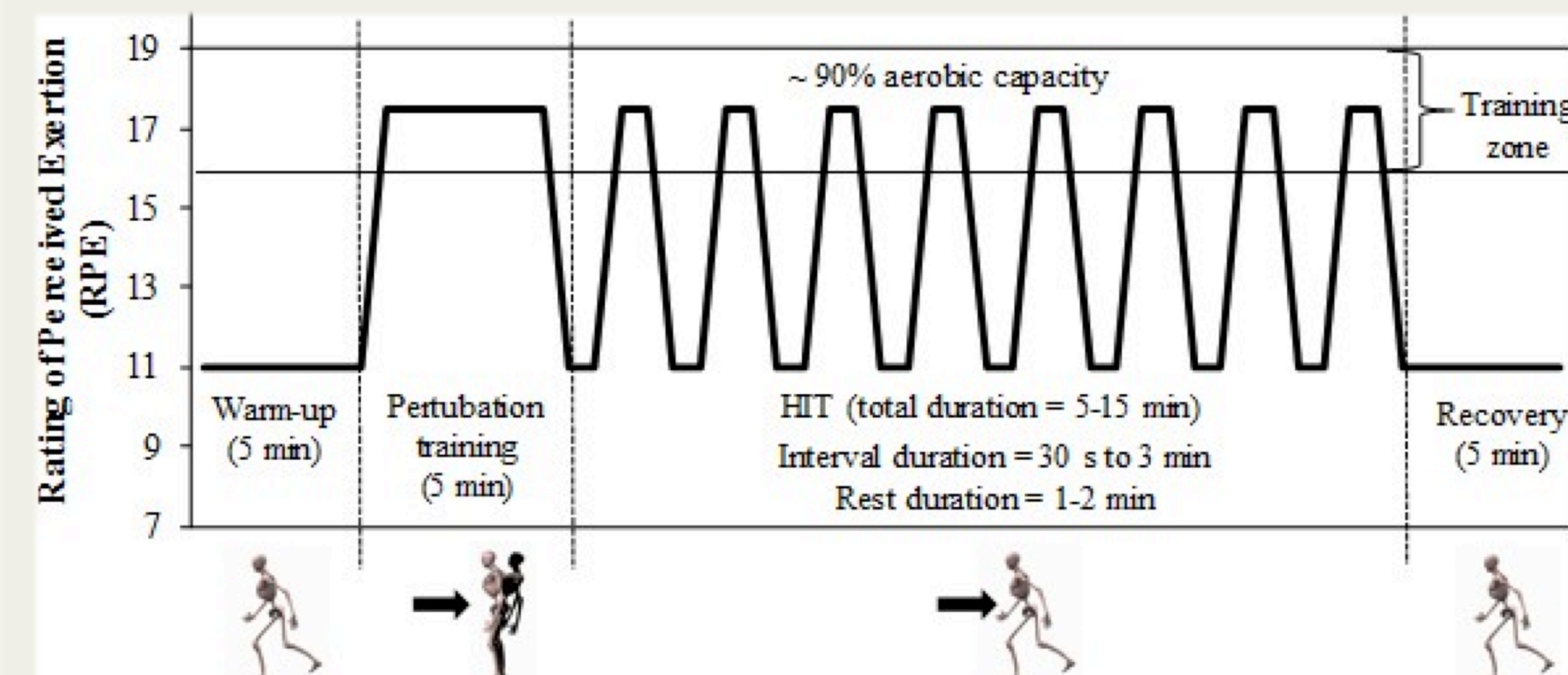


Figure 2- High-intensity interval training (HIT) exercise protocol

Methods

To be included in the study, participants had to have been previously diagnosed with knee or hip OA through clinical history, physical examination, and radiographic analysis. Subjects participated in a double pretest-posttest design whereby participants completed a two-week non-exercise control period followed by a six-week aquatic exercise intervention period. Participants completed the KOOS (5) questionnaire upon beginning and completing the exercise intervention period. Key outcomes from the questionnaire included measures of joint pain, other symptoms (SPT), function in daily living (ADL), function in sport and recreation (SAR) and knee related quality of life (QOL). Pretest and posttest measures included balance and sensory organization tests (SOT) through computerized dynamic posturography (CDP) using the SMART EquiTest system (Figure 3), arguably the gold standard system for balance and stabilization testing(6).

Participant's perception of immediate and usual joint pain was assessed using a continuous visual analog pain scale (3). The exercise protocol included balance training and high-intensity interval training (HIT) in an aquatic treadmill using water jets to destabilize while standing and walking to achieve high ratings of perceived exertion while walking (Figures 1 and 2).

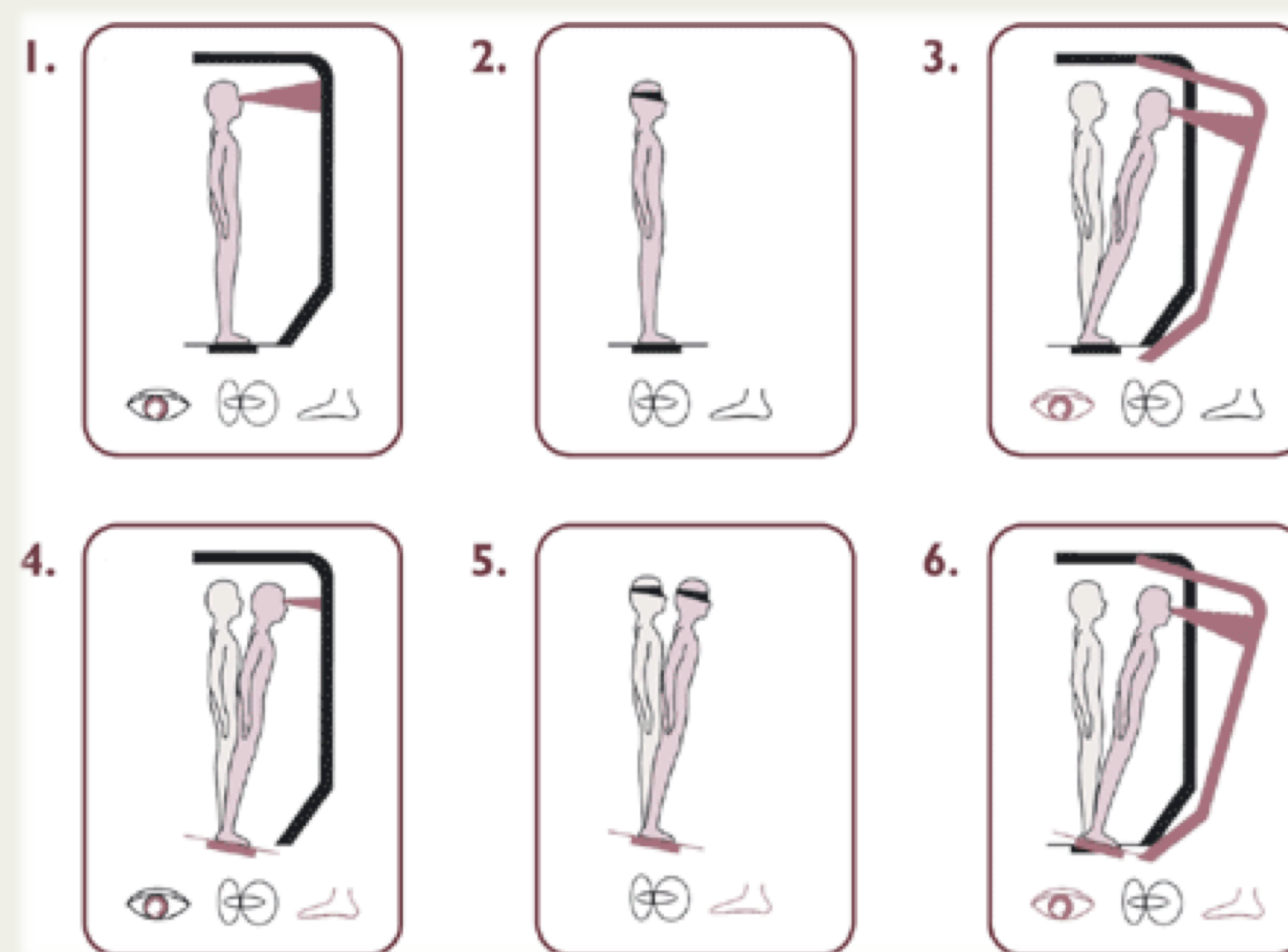


Figure 3- Computerized Dynamic Posturography tests

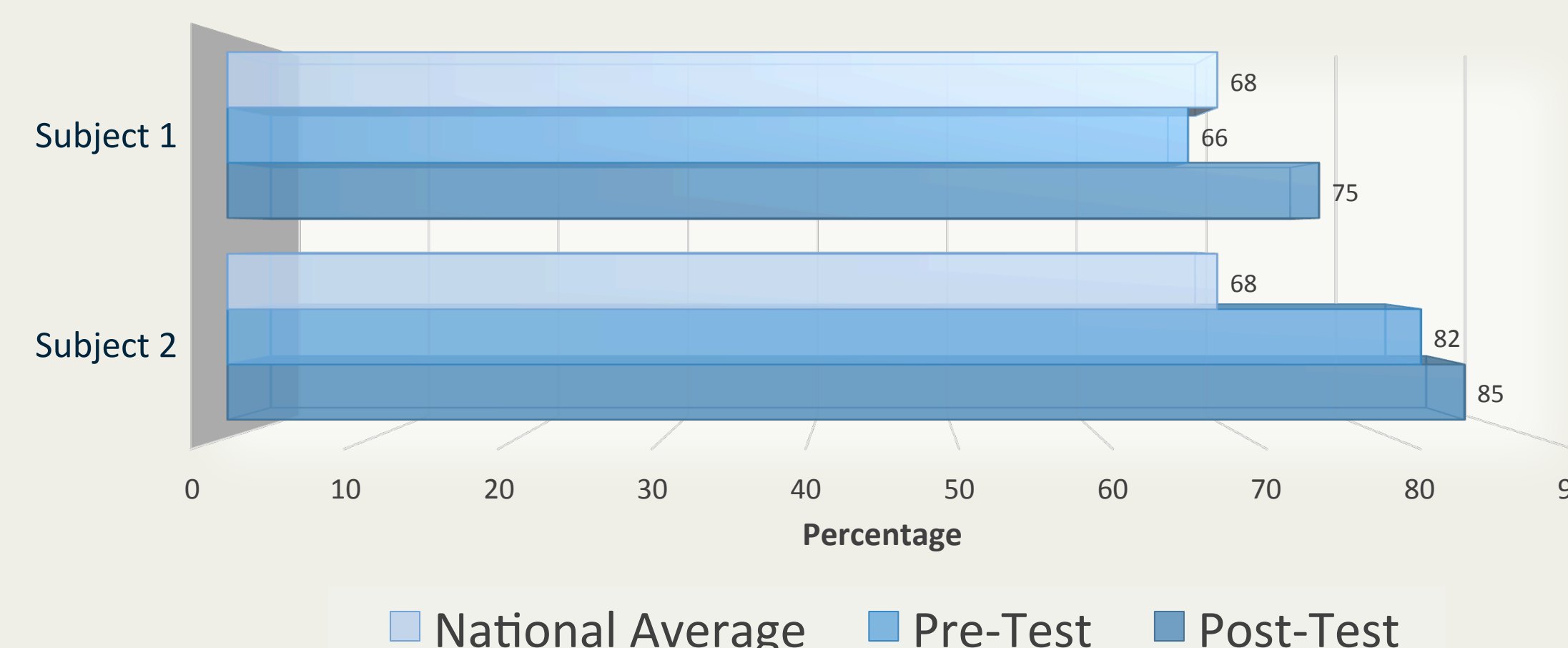


Table 1- Composite Scoring for Sensory Organization Test

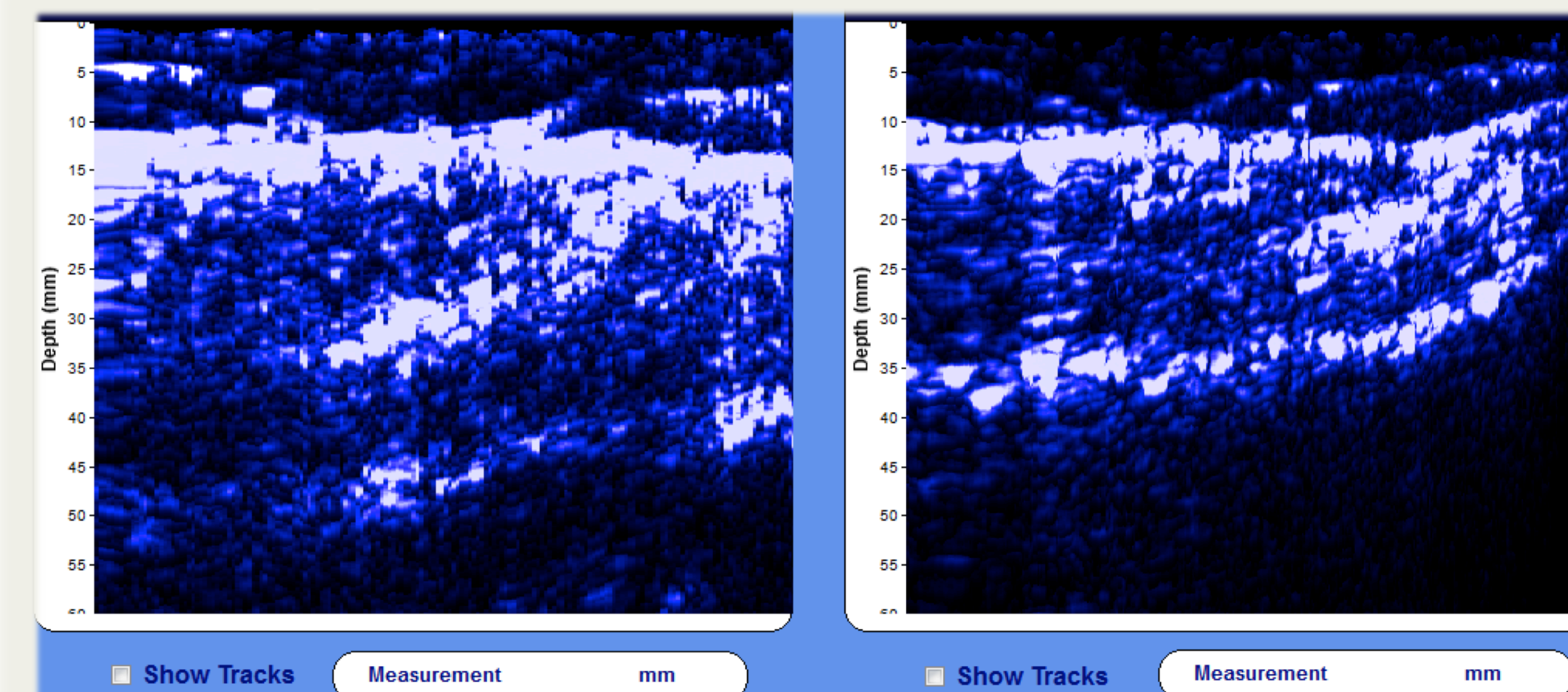


Figure 4- Pre-post muscle thickness ultrasound readings

Results

Results included reduced joint pain (pre = 35.39 ± 9.23 mm versus post = 1.46 ± 1.54 mm), improved balance (equilibrium pre = 74.0 ± 8.0 versus post = 80.0 ± 5.0), but a slight decrease in mobility (walk pre = 7.63 ± 0.38 s versus post = 7.88 ± 1.24 s) after participating in the exercise protocol. Data showing a decrease in mobility times, contrary to our former hypothesis, suggests that further analysis is needed in order to determine causes of this difference in results. Exploratory muscle thickness measures remain indeterminate within the associated sample size and length of testing period, which we assume is due to a difference in exact locations between pretest and posttest measurements.

Conclusion

Aquatic treadmill exercise that incorporates balance and HIT training can be well tolerated by patients with OA and can be effective at managing symptoms of OA.

Resources

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