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The Effectiveness of Aquatic Therapy, Robot Assisted Gait Training, and Virtual Reality on Patients with Parkinson's Disease: A Literature Review

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The Effectiveness of Aquatic Therapy, Robot Assisted Gait Training, and Virtual Reality on Patients with Parkinson's Disease: A Literature Review

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Introduction

Parkinson's disease (PD) is a progressive disorder affecting a person's central nervous system, with impairments in
● Postural control
● Gait
● Balance,
● Reaction time

Individuals often have difficulty with
● Activities of daily living
● Falls
● Impulsivity
● Freezing of gait

Patients diagnosed with PD will show a slow decline in activities and therefore, it's important for these patients to maintain physical activity.

Our literature review focuses on the effectiveness of the interventions to improve reaction time, gait, and balance on patients with PD by using aquatics, virtual reality, and robot assisted gait training.

Methods

A literature review searching PubMed for key words: "Parkinson's disease", "aquatic therapy", "robot-assisted gait training", "pathophysiology", "virtual reality", "end-effector", and "stepping time".

Total yield: 7,222 articles.

Search narrowed to include only pathophysiology, discussion of end-effector technology and the target interventions, and articles published in English in the past 10 years.

Total articles in included in literature review: 10

ekoBionics, 2020

Aquatic Therapy

Three intervention articles reviewed:
1) Halliwick method vs. traditional aquatic therapy vs. land-based exercises[4]
● Halliwick method includes complex rotational movements and core stabilization
● No statistically significant differences between or within groups
● Halliwick exercise group improved more on mini-BESTest, indicating possible improvements in anticipatory and reactive postural control.

2) Aquatic therapy to improve cytokine modulation[5]
● One month after completing aquatic therapy program
  ○ Pro-inflammatory marker (MCP-1) decreased
  ○ Anti-inflammatory marker (IL-1ra) increased.
● Aquatic therapy may promote long-term reduction of inflammation

3) Aquatic therapy for freezing of gait[5]
● Aquatic therapy plus land therapy can help reduce freezing of gait
● Found to be equally effective as land-based therapy alone
● Aquatics can be used to improve this condition.

Long, 2019

Robot Assisted Treadmill Training

Robot-assisted gait training occurs via
● Exoskeleton - robotic system matches joints
● End-effector - uses footplate to assist with gait

Reviewed one intervention article using end-effector robotic gait training (RAGT)[7]
● RAGT and treadmill training can both improve gait
● More improvement in freezing noted with RAGT

Weber-Nowakowska, 2011

Virtual Reality

Virtual reality (VR) technology:
● Helps provide visual, auditory, and somatosensory stimuli
● Can supply real-time feedback during specific motor tasks[8]
● Can give sensory stimulation throughout their treatment program.[8]
● Can be used to improve gait and balance.

Reviewed one intervention study comparing VR and conventional rehabilitation.
● Both groups demonstrated significant improvements in balance and gait.
● VR group demonstrated more improvement in the Berg Balance Scale, Timed Up and Go Test, an Functional Gait Assessment
● VR may be beneficial in rehabilitation.

Rehab Alternatives, 2017

Conclusions

Integration of interventions not typically used for individuals with Parkinson's Disease can be beneficial in improving balance and gait.
● Aquatic therapy can help to improve balance. Halliwick aquatics, traditional aquatics, and land-based therapy may all improve balance in individuals with PD.
● RAGT can be used with individuals with Parkinson's Disease who have freezing of gait leading to activity limitations and participation restrictions. Both treadmill training and RAGT may help improve gait.
● Virtual Reality can be used to improve balance in individuals with Parkinson's Disease. Both traditional PT and VR may help to improve balance and gait.

Clinical Implications

● Aquatic therapy can be used in conjunction or in place of conventional physical therapy intervention to improve balance in individuals with PD.
● RAGT can be used to decrease freezing of gait occurrences in patients with PD.
● VR can be used in conjunction to or in place of conventional PT intervention to improve balance in patients with PD.
● These practices may be enjoyable for patients with PD and can have therapeutic benefits.

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