

CLINICAL CASE STUDY

Innovative Virtual Reality–Based Neurorehabilitation for Cognitive and Motor Recovery in Underserved Rural Parkinson's Populations

Using the Smart Therapy Complete Solution by Neuromersive

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Technology Used	Smart Therapy Complete Solution Neuromersive
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Executive Summary

This case study presents findings from a randomized controlled pilot trial evaluating the Neuromersive Smart Therapy Complete Solution, an immersive virtual reality (VR) physical therapy platform, in the treatment of Parkinson's disease (PD) in an underserved rural population. Conducted at Fresno State's CDTIH and presented at APTA CSM 2026, the study compared virtual reality physical therapy (VRPT) to conventional physical therapy (PT) over a three-week intervention period.

Results indicate that the Smart Therapy Complete Solution delivered clinically meaningful improvements in dynamic balance among participants, positioning it as a viable, scalable, and patient-centered solution for neurorehabilitation in settings where access to specialized care is limited.

Background & Clinical Need

Parkinson's disease is a progressive neurodegenerative disorder that profoundly limits functional independence, affecting motor control, balance, gait, and cognitive function. The burden of PD is particularly severe in rural and agricultural regions such as Fresno County, California, where pesticide exposure is a known risk factor and access to specialized rehabilitative care is limited by geography, transportation barriers, and financial constraints.

The 2025 state virtual reality physical therapy meta-analyses demonstrated that VRPT produces balance outcomes in PD that are comparable to those of conventional therapy, attributed to neuroplasticity stimulation through multisensory engagement. Despite this evidence, the majority of existing research has focused on non-immersive VR platforms. This trial addresses that gap by deploying a fully immersive, commercially available system in an underserved community.

About the Smart Therapy Complete Solution

The Smart Therapy Complete Solution, developed by Neuromersive, is a purpose-built immersive virtual reality system designed for clinical neurorehabilitation. Unlike non-immersive screen-based systems, the Solution delivers fully immersive environments that engage multiple sensory systems simultaneously; auditory, visual, and proprioceptive, to promote neuroplasticity and patient motivation.

VR Therapy Games Used in This Study

- Haven: Box breathing with upper extremity flexion and extension, coordinated with the participant's breathing pattern. Designed for respiratory engagement and upper limb mobility.
- Fowl Play: Dynamic postural stability training through cannon ball dodging at varying speeds and frequencies. Targets reactive balance and anticipatory postural adjustments.
- Loko Sprint: Seated/standing marching through a virtual environment for up to five minutes. Designed to simulate gait activity while reducing fall risk and providing environmental feedback.

Each VR session lasted 20 minutes of therapeutic exercise, providing an engaging and scalable alternative to traditional gait and balance training.

Study Methods

Study Design

Randomized controlled pilot trial with a 2×2 ANOVA design comparing pre- and post-test changes between and within groups. Bonferroni correction was applied for multiple comparisons.

Participants

- 17 participants enrolled; 13 completed the study (4 excluded due to low MOCA score, personal factors, or medical regimen changes)
- Average age: 75.9 years
- Group allocation: 4 conventional PT, 9 VRPT

Intervention Protocol

VRPT Group (Smart Therapy Solution)	Conventional PT Group
20 min VR therapeutic exercise (3 games)	15 min therapeutic exercise
Home exercise program (HEP) 4×/week	15 min dynamic balance
Twice weekly × 3 weeks	20 min gait activities (step-ups, lunges, theraband, diagonal shoulder flexion 3×10)

Outcome Measures

- Parkinson's Fatigue Scale (PFS)
- Freezing of Gait Questionnaire (FOGQ): self-selected and fast 10-meter walk test (10MWT)
- Mini-BESTest: dynamic balance assessment
- MoCA (Montreal Cognitive Assessment):cognitive screen
- Statistical methods: Wilcoxon signed-rank test and Mann-Whitney U test

Results

Balance (Mini-BESTest)

The VRPT group using the Smart Therapy Complete Solution demonstrated significant within-group improvement in dynamic balance as measured by the

Mini-BESTest. The Wilcoxon signed-rank test confirmed statistically significant improvements in the VR group ($Z = 2.1$, $p = 0.041$). No significant difference was observed within the conventional PT group ($Z = 0.7$, $p = 0.620$). ~~No statistically significant between-group difference was found on this measure.~~

Gait Speed (10MWT)

~~Gait speed did not significantly change within either group or between groups at follow-up. Both groups preserved baseline gait speed over the short duration of the intervention. This finding suggests that immersive VRPT may preferentially target postural control strategies over locomotor velocity at this intervention duration.~~

Fatigue & Freezing of Gait

~~No statistically significant differences were observed in PFS or FOGQ scores within or between groups (PFS: $F = 0.498$, $p = 0.488$; FOGQ: $F = 0.467$, $p = 0.502$), suggesting that the three-week intervention may be insufficient to detect changes in fatigue and freezing outcomes. Longer-duration studies are warranted.~~

Key Clinical Takeaways

- The Neuromersive Smart Therapy Complete Solution produced significant within-group improvements in dynamic balance (Mini-BESTest) in a rural Parkinson's population over just three weeks.
- Immersive VRPT is a feasible and engaging alternative to conventional PT in underserved rural settings, where access to specialized physical therapy is often impossible due to transportation and financial barriers.
- VR-based therapy may preferentially target postural control and balance, potentially through multisensory neuroplastic engagement that activates neural pathways underlying stability.
- The platform's patient engagement properties: immersive environments, multisensory feedback, game-based interaction, support motivation and adherence, both critical for neurological rehabilitation.
- ~~Short intervention windows may not be sufficient to detect changes in fatigue or gait freezing; longer trials with this device are recommended.~~

Clinical & Commercial Implications

This pilot study provides early evidence supporting the deployment of the Neuromersive Smart Therapy Complete Solution in real-world community physical therapy settings, including rural and underserved clinics. As VR hardware becomes more accessible and reimbursement pathways for digital therapeutics continue to develop, immersive neurorehabilitation systems such as this have the potential to meaningfully expand access to evidence-based Parkinson's care.

Neuromersive's platform addresses a critical unmet need: the growing population of individuals with PD in agricultural and rural communities where the disease burden is elevated and treatment access is lowest. This study adds to a growing body of evidence supporting VRPT as a clinically effective, scalable, and patient-centered solution for neurological rehabilitation.

Future Research Directions

- Larger, adequately powered randomized controlled trials with longer follow-up periods (12+ weeks)
- Assessment of impact on fatigue, freezing of gait, and quality of life over extended use of the Smart Therapy Complete Solution
- Exploration of telehealth-integrated VRPT delivery models for rural and homebound PD patients
- Investigation of dose-response relationships (session frequency, duration, game type) and their neuroplastic effects
- Studies examining engagement metrics, adherence, and patient-reported outcomes with the Neuromersive system

Citation

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