

Preliminary Evidence of Factors Associated with Vestibular Rehabilitation Outcomes of Dizziness Related to Mild Traumatic Brain Injury (mTBI)

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Relevance for Veterans and Service Members: Digital vestibular rehabilitation effectively manages dizziness after mTBI allowing clinicians to monitor remotely. Initial severity of symptoms was associated with severity of symptoms after vestibular rehabilitation.

INTRODUCTION

- Dizziness and imbalance are common sequelae of mTBI, often persist six months or longer, and negatively impact quality of life.¹
- Gap in access:** Although Vestibular Rehabilitation Therapy (VRT) is recommended for chronic dizziness and imbalance related to mTBI, only a fraction of individuals in need receive VRT.^{2,3}
- VRT is often helpful, but not all patients benefit.²
- Purpose:** Determine: (1) effectiveness of a digital, gamified VRT (D-VRT) application (app) compared to standard VRT (S-VRT) (Figure 1); and (2) factors associated with rehabilitation outcomes.

METHODS

- Participants:** 30 Veterans/Service Members (V/SM) and civilians with subacute or chronic dizziness (Table 1)
- Procedures:** Ongoing multi-center RCT (target = 68) with pre- and post-treatment assessments
- VRT Treatment:** 4 weeks customized treatment including habituation, gaze stabilization and/or balance/gait exercises

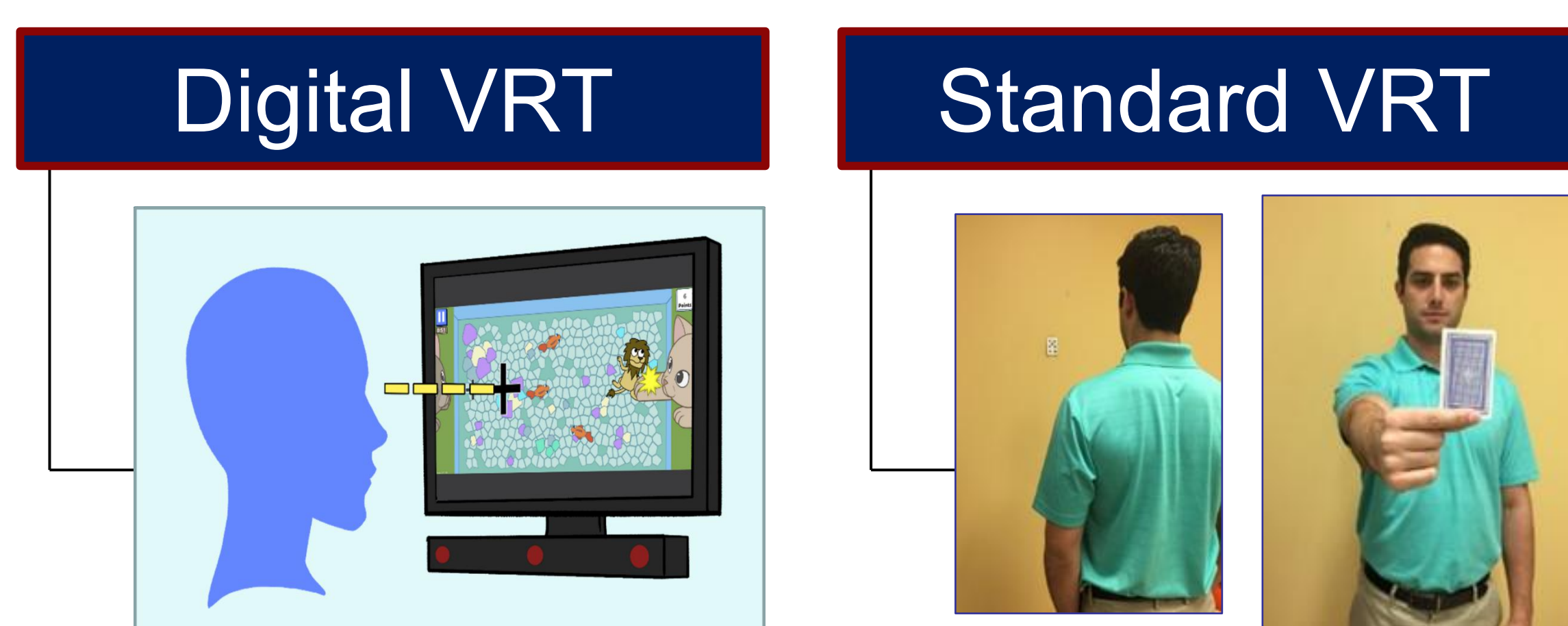


Figure 1. Participants randomized to treatment group according to method of delivery

- Outcome Measures:**
 - Dizziness Handicap Inventory (DHI)
 - Activities-specific Balance Confidence scale (ABC)
 - Disability Rating
 - Modified Motion Sensitivity Scale (mMST)
 - Tests of balance/gait: 10-m Walk Test (10MWT), Functional Gait Assessment (FGA)
- Data Analysis:**
 - T-tests to determine within and between group differences in outcome measures
 - Generalized linear model to explore factors that impact outcome (Post-DHI)

RESULTS

Table 1. Participant Characteristics (mean (SD) or n (%))

Variable	D-VRT (n = 15)	S-VRT (n = 15)	Sig. (p or χ^2)
Age (years)	41.7 (11.0)	49.9 (13.5)	.08
Gender (male/female, n)	12/3	13/2	.62
Service Members/Veterans/Civilians (n)	11/1/3	9/3/3	.55
Functional Comorbidity Index (0-18)	3.9 (2.1)	3.9 (1.9)	1.00
History of migraine (yes, n, %)	14 (93%)	15 (100%)	.31
History of anxiety (yes, n, %)	12 (80%)	12 (80%)	1.00
History of depression (yes, n, %)	9 (60%)	7 (47%)	.46

- Significant within-group improvements in most outcome measures, but no significant between-group differences in improvement of any outcome measures (Table 2)
 - Adherence to a home exercise program did not differ between groups (D-VRT = 63±21% vs. S-VRT=71±21%)
- Using Generalized linear modelling to explore factors that impact outcomes, Pre-DHI was the only significant predictor of rehabilitation outcome ($F = 23.08$, $p < .001$, $\eta^2 = .591$)
 - Variables not significant: Age ($p = .397$); Vestibular abnormality ($p = .924$); Mental health comorbidity ($p = .756$); Exercise adherence ($p = .347$)

Table 2. Comparison Of Rehabilitation Outcomes (mean (SD))

Measure	D-VRT			S-VRT		
	Pre	Post	Sig. (p)†	Pre	Post	Sig. (p)†*
DHI (/100)	45 (19)	36 (22)	.11	38 (17)	31 (19)	.004/.78
ABC (%)	75 (17)	82 (18)	.04	76 (16)	81 (16)	.20/.63
Disability rating (/5)	2.3 (1.0)	1.8 (1.3)	.15	2.2 (0.9)	1.8 (1.1)	.11/.89
mMST (/100)	16 (10)	10 (10)	.02	15 (10)	11 (9)	.07/.66
10MWT (m/s)	1.12 (0.19)	1.27 (0.18)	.002	1.16 (0.21)	1.25 (0.17)	.02/.56
FGA (/30)	23 (5)	26 (3)	.01	22 (5)	25 (3)	.002/.86

DHI: Dizziness Handicap Inventory; ABC: Activities-specific Balance Confidence scale; mMST: modified Motion Sensitivity Scale; 10MWT: 10-m Walk Test; FGA: Functional Gait Assessment
Significance (p-value): † within-group differences/*between-group differences for change score

DISCUSSION

Data collection is on-going; findings are preliminary

- Participants demonstrated improved symptoms, balance and gait following a 4-week episode of VRT. This supports expanded access to remotely monitoring D-VRT as a viable alternative to S-VRT.
- Consistent with prior work⁴, initial severity of symptoms (Pre-DHI) was associated with the outcome (Post-DHI).
 - Participants who started with more severe dizziness-related symptoms improved but remained with moderate to severe symptoms after VRT.
- Unlike previous studies which reported worse outcomes with younger age⁴, we found no association between age and outcome.
- Anxiety, depression, and migraine are comorbidities known to negatively impact rehabilitation outcomes in the mTBI population.⁴ These were highly prevalent in our sample, which may explain the lack of association.
- Exercise adherence was very good and similar across groups and was not associated with rehabilitation outcomes.

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