Will Vestibulo-Ocular Reflex and balance rehabilitation reduce visual deficits & improve stability of a patient with Multiple Sclerosis?

Natalie A. Hunt
Jennifer P. Kiggins
Will Balance and VOR Rehabilitation Decrease Deficits and Improve Stability in a Patient with Multiple Sclerosis?

Natalie Hunt, Jennifer Kiggins, Theresa Miyashita Ph.D, ATC
Sacred Heart University, College of Health Professions, Fairfield, CT

INTRODUCTION

MS is a chronic autoimmune neurological disease of the central nervous system (CNS) that affects approx. 2.3 million individuals worldwide.1,2 Many patients experience episodes of potentially reversible neurological deficits, which are often followed by progressive neurological deterioration. Relapsing-remitting MS is the most common diagnosis affecting about 85% of MS patients, and is characterized by the abrupt onset and remission of various symptoms followed by periods of remission.3 The potential symptoms include but are not limited to: diziness, vestibular dysfunction, fatigue, instability, decreased strength, and impaired cognition.3 There is currently no cure for an MS diagnosis, but visual, cognitive, and somatosensory rehabilitation and medications, are being used in an attempt to decrease symptomology and slow down progression.4 Research has shown the effectiveness of vestibular rehabilitation in reducing diziness, improving gait, and balance function in post-concussion patients.4 These patients are comparable to those with MS due to similar CNS and vestibular disruption. Research suggests Vestibulo-Ocular Reflex (VOR) rehabilitation is beneficial for a patient experiencing vestibular dysfunction and instability.4 The subject was diagnosed with relapsing-remitting MS in 2003 and experiences visual and balance deficits on his left side. There is limited research on a rehabilitation program combining the effects of both VOR and balance on a single patient with MS.

METHODS

Pre and post-test data were collected using the VSR™ sport and inVision™ systems by NeuroCom. Testing screen 1.1m from the ground, force plate 1.1m from screen, Participant’s eyes 2.13m from the screen for vision exercises. VOR was assessed using inVision™ system to measure: perception time (PTT), static visual acuity, gaze stabilization (GST), and Dynamic Visual Acuity (DVA). The subject wore a calibrated head accelerometer provided by the inVision™ system to measure head velocity. Balance was assessed using VSR™ Sport System to measure: Limits of Stability (LOS), and Stability Evaluation Test (SET). The subject completed these tests on a force plate and high-density foam, provided by the VSR™ Sport System, to measure his center of gravity and sway velocity. The participant completed the baseline tests in the following order: PTT, GST, DVA, SET, and LOS.

RESULTS

The patient had an overall improvement in VOR scores between pre and post-tests (Table 1). From pre to post-test the patient achieved the best possible score of 20ms for PTT. GST had a bilateral increase in achieved average head velocity from pre to post-test with a 44.6% increase on the right from 121 to 175 deg/s and a 60% increase on the left from 98 to 157 deg/s. The patient improved from favoring his right side by 11% to favoring the impaired left side by 5%. PTT, GST, DVA percent changes are highlighted in Table 1. Balance pre and post-test improvements are highlighted on Table 2. LOS forward reaction time improved from 1.13 seconds to 0.49 seconds. Forward movement velocity improved from 1.9 deg/sec to 4.7 deg/sec and to the right from 2 deg/sec to 6.8 deg/sec. VOR velocity decreased on tandem foam from 10.9 to 4.1 deg/sec. A majority of the scores improved on the stability evaluation test (Figure 3).


discussion

Patients with MS depend strongly on vision for balance control because of proprioceptive and vestibular deficits.5 This rehabilitation protocol combines VOR and proprioceptive exercises to potentially provide increased stability, coordination within motor functions, and higher quality of life for a patient with MS. VOR is a reflex used to stabilize gaze, which provides a stable environment for retinal focus.5 As an individual ages, their VOR is increasingly impaired and negatively effects their perception of balance.6 There is no research using the inVision™ system for VOR rehabilitation on patients with MS, but similar symptoms from head induced trauma have decreased from these VOR interactive exercises.7 According to Canty it is necessary to incorporate VOR therapy and rehabilitation programs for patients who are experiencing balance deficits.8 It is necessary to also train balance in conjunction with VOR, as both of these systems work together during ADLs.9 The scores of both VOR and balance improved throughout the protocol. Post-test VOR scores have a greater increase from baseline than balance scores. Studies show playing exergames on an unstable surface, such as foam, appears to be an effective way to improve balance and gain in patients with MS. The integration of exergames has a positive effect on adherence and is potentially beneficial for the long-term effectiveness of rehabilitation programs.5,10 Our results indicate the combination of VOR and balance rehabilitation has a positive effect on a patient with MS experiencing these specific symptoms. Using the systems provided by NeuroCom® is an effective way to maintain the patients adherence and utilize practical balance and VOR exercises. The progression in this protocol was based off of the patient’s ability to perform and therefore can vary amongst other patients. Further research should compare the effects of a similar rehabilitation protocol on multiple patients suffering from various symptoms.

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REFERENCES