The Effects of AlterG® Anti-Gravity Treadmill® Training on Spinal Cord Injury Rehabilitation

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Introduction

- Body weight supported treadmill training (BWSTT) has been used to help patients retrain muscles, gain endurance, relearn to walk, and improve quality of life.
- Previous studies for subjects with spinal cord injuries have shown an improvement in walking ability, functional independence, and subjective well-being.
- The basis behind BWSTT is the belief of central pattern generators in the spinal cord, which are thought to control rhythm and timing of movements.
- The Anti-Gravity Treadmill® by AlterG® has provided a new form of BWSTT, and there is evidence to support the use of this system for some neurological conditions, but the evidence for subjects with spinal cord injuries is lacking.

The purpose of this case study is to look at the effects of AlterG® anti-gravity treadmill training on a single subject with a chronic incomplete spinal cord injury in the aspects of gait speed, quality of gait, lower extremity strength, and quality of life.

Methods – Single Subject Case Study

Subject
- 32 year old female s/p T10 incomplete SCI (2004) due to motor vehicle accident
- Presents with the following: decreased walking speed, altered gait mechanics, ambulation with cane, spasticity, and clonus

Intervention
- 14 training sessions over 8 weeks
- Warm-up parameters: time (3 mins), speed (0.7 mph), grade (0), and % weight bearing (25%) remained same each session
- Intervention parameters: time, speed, grade, % WB
  - Changed every other week
- Cool down parameters were same as warm up

Results

Outcome Measures

<table>
<thead>
<tr>
<th>Body Function &amp; Structure</th>
<th>Activity</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ↑Knee flexion strength</td>
<td>• ↑Distance in 6 MWT</td>
<td>• ↑QOL Index score</td>
</tr>
<tr>
<td>• ↑Velocity in 10 MWT</td>
<td>• ↑Reintegration to Normal Living score</td>
<td></td>
</tr>
</tbody>
</table>

Graph 1. Knee Strength

Graph 2. 6 Minute Walk Test

Graph 3. 10 Meter Walk Test - Self Selected Pace

Graph 4. 10 Meter Walk Test - Face Pace

Graph 5. Quality of Life Index

Graph 5. Increase in health & functioning and psychological & spiritual categories in the QOL Index, SCI Version.

Graph 2: Improvement in distance covered during 6 MWT from pre to post intervention.

Graph 3 and 4: Little to no change in both self-selected and face pace velocities during the 10 MWT.

Subject Quotes

During session 5...
"When I'm on the Alter-G I feel like I have a normal person's walk."

One month post-intervention...
"I feel like I can bend my right knee farther."

Discussion & Clinical Relevance

- Increase in knee flexion may lead to improved gait mechanics.
- An improvement in 6 MWT time could help with community ambulation.
- A higher velocity for 10 MWT demonstrates a higher gait speed. This may translate to activities that require higher speed within the community.

Conclusions

- Body weight supported treadmill training on the AlterG® appears to improve all areas of the ICF model for a subject with a chronic incomplete spinal cord injury.
- Due to the lack of research with this patient population, further investigation is warranted.

References:

Background

- The knee joint is the most common joint affected by OA, resulting in pain, and is routinely treated by a Total Knee Replacement (TKR).
- The incidence of TKR’s per year is projected to rise from 700,000 in 2015 to 3.48 million surgeries by year 2030.
- Studies have found that functional performance one year post-arthroplasty is significantly lower than functional performance in healthy adults, and the optimal rehabilitation regimen is uncertain in older adults.
- AlterG is weight supported treadmill system that allows body weight to be reduced by 80% while walking forward or backward on a treadmill.

Purpose

- To determine if body weight supported treadmill ambulation using the AlterG® can increase physical activity and physical function to a greater degree than the standard care for patients post TKR.

Methods

- Inclusion criteria: Subjects receiving Medicare (age > 65), undergoing TKR within the last 3-6 months, and receiving physical therapy no more than once per week.
- Pre-test/post-test study design in which subjects were randomly assigned to either a control group - step count only (STEP), or an intervention group - step count + AlterG® (STEP+).
- Four subjects: STEP+: 2 women 1 man, STEP: 1 woman
- STEP: Pedometer tracking of physical activity for four weeks with weekly meetings to check up and discuss physical activity and health goals related to weight management, blood pressure, and diet habits.
- STEP+: Same as STEP group plus hour long sessions, twice a week, walking on the Alter-G®. The goal was to achieving pain free walking at a minimum of 2 mph for 30 minutes. RPE, pain, and weight were monitored at each session.
- Main outcome measures: 6 min walk test, 5 x chair rise, Timed Up and Go, Single Leg Stance, LEFS, Lower Extremity ROM, Lower Extremity Strength, Average Daily Steps, and NHANESIII

Results

- LEFS scores increased across the board, showing an increase in self reported functional ability.
- Timed Up and Go improved an impressive amount, equal to, or greater than the point of age related norms.
- Patients’ reported RPE during AlterG sessions decreased along with an increased walking speed and distance.

Discussion

- Average daily steps trended upwards for the STEP+ group due to the increase physical activity and functional capacity.
- LEFS scores increased across the board, showing an increase in self reported functional ability.

Limitations

- Limitations of this study include but are not limited to the number of participants, withdrawal of control from study, length of study, and compliance with and accuracy of pedometer recordings.
- Ideally the speed, grade, and body weight supported would be more standardized for all participants.

Conclusions

- The study’s results currently show a trend that subjects who were in the STEP+ group improved their outcomes measures for the 6MWT, TUG, Chair Rise time, Lower Extremity Functional Scale, and daily steps.

Resources

- http://www.htherapy.co.za/AlterG_Anti-Gravity_Treadmill
Chronic Ankle Instability Due to Repeated Eversion Ankle Sprains: A Case Report
Noah Tucker, SPT
Department of Physical Therapy, Georgia Regents University, Augusta, GA

INTRODUCTION
One of the most common injuries in sports is an ankle sprain. While there are different types of ankle sprains what they all have in common is that there is a high probability of reoccurring ankle sprains after the initial sprain. With repeated injury the ligaments will start to become lax and no longer function as efficiently as before. This laxity can cause patients to be at increased risk for ankle injuries and some individuals develop gait disparities and this is termed as Chronic Ankle Instability (CAI). While there is a good amount of research indicating interventions that are effective in managing patients with this chronic condition for inversion injuries there is barely any research studies focused on patients with CAI due to eversion injuries or when the patient is starting at a low level of function. The case study aims to examine an intervention of a patient with an eversion sprain who is not functioning well, with a focus on trying to strengthen passive and eccentric stabilizers through functional activities.

METHODS

Case Description

History:
The patient was a 18-year-old male who was referred to physical therapy for foot pain and instability in his left ankle. The original mechanism of injury was approximately three-and-a-half years ago when he had a high ankle fracture of his distal fibula while playing lacrosse. Since the initial fracture the patient has had three eversion related high ankle sprains. Since resolving his last sprain 4 months ago he has reported feeling unstable in his left ankle and pain with any ankle movements and is unable to run, which is the reason for his referral. The patient also reports that the pain and instability has decreased his participation in all Activities of Daily Living (ADLs), and has set his major goals of returning to Lacrosse without pain or fear of another ankle sprain. The patient is also very guarded with his left ankle due to the pain.

Examination:
- Left ankle Active Range of Motion (AROM) and Passive Range of Motion (PROM) limited in all directions
- Foot and Ankle Disability Index Sports Model (FADI-S)
- Initial Total Score = 44/136
- NPRS
- 8/10 Left ankle pain at rest and when performing ADLs
- Diagnostic tests:
  - Anterior Drawer Test (-), Talar Tilt Test (-), External Rotation Test (+), Squeeze Test (+)

Evaluation:
Upon completion of the examination, it was noted that the patient had limited AROM and PROM of the left ankle and would not allow physical manipulation due to the tenderness to touch. The FADI-S score indicated that the patient was severely disabled throughout all of his functional abilities due to his pain and instability.

Diagnosis:
- Medical: Left Chronic Ankle Instability
- Physical Therapy: Practice Pattern 4D: impaired joint mobility, motor function, muscle performance, and range of motion associated with connective tissue dysfunction. The ICD-9 Codes are 718: Other derangement of joint, 728.4: laxity of ligament, and 845: sprains and strains of ankle.

Prognosis:
For this case the patient was seen in clinic 2-3 days/wk. for 25-30 minutes/visit as the patient’s schedule permitted. This came to a total of 15 visits in total before the discharge date

Interventions:
Therapeutic modalities like thermal agents, therapeutic exercises including theraband strengthening, single and double leg balance exercises, neuromuscular training with Bosu Ball, sports specific training drills (Lacrosse) were performed 2-3 times a week. Table 1 below shows the treatment protocol performed.

TABLE 1

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Focus On</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase One</td>
<td>Elastic Theraband Strengthening</td>
</tr>
<tr>
<td>Phase Two</td>
<td>Single-leg balance exercises, double-leg balance exercises, neuromuscular training with Bosu Ball.</td>
</tr>
<tr>
<td>Phase Three</td>
<td>Therapeutic exercises focusing on sports specific drills looking at increasing eccentric stabilization.</td>
</tr>
</tbody>
</table>

RESULTS / OUTCOMES

The Foot and Ankle Disability Index Sports Model (FADI-S) and Numeric Pain Rating Scale were used to evaluate the progress of the patient. See Table 2 and Figure 1. After 7 weeks of treatment the patient’s resting pain went from a 8/10 to no pain at rest. The FADI increased from a 44/104 to 89/104, the Sports component increased from a 8/32 to 22/32. and the Total FADI-S increased from a 44/136 to 111/136.

DISCUSSION
The patient responded favorably to the therapeutic exercises, achieving clinically meaningful results. The difficulty stems in determining which interventions truly resulted in which gains in ROM, pain, and function. It is difficult to determine which phase of intervention caused the in changes to the FADI-S. The most that can be determined is that the total management was effective in increasing the patients level of function.

CONCLUSION
While it can be said that the patient did show improvements from the intervention it cannot be said what is the cause of each improvement. The fact that the FADI-S was given at incorrect times for “Re-evaluation” and that the “Sports Phase” had to be cut short all impair the ability to make a clear conclusion on the effectiveness of management on patients with CAI due to repeated eversion injuries. This case report does have some merit in that it shows that functional improvements can be obtained and which interventions resulted those improvements. This study can only show that improvements did occur.
The Effectiveness of Aquatic Therapy for a Person with a Chronic Spinal Cord Injury – A Case Study

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1Georgia Regents University, Augusta, Georgia

Background
Spinal Cord Injuries have a significant impact on quality of life, life expectancy, and come with an economic burden. Primary care is expensive and often the individual has a decrease in or loss of income. There are many options for treating a patient with a SCI, but it is most important to learn the goals of your patient and design your interventions around those goals.

Aquatic therapy is any form of treatment or exercise performed in the water for relaxation, fitness, physical rehabilitation, or other therapeutic benefits. Aquatic therapy is used to treat a variety of health conditions and ailments. The physical properties of water contribute to its effectiveness including but not limited to its density, buoyancy, viscosity, and thermodynamics. There is a limited amount of research on the effect of aquatic therapy in a SCI population.

Purpose
To assess the effectiveness of aquatic therapy intervention for a patient with a chronic SCI

Subject
- 58 Year Old African American Female
- T10 ASIA C
- MOI: Tumor resection from thoracic spine ~3yrs ago
- Goals: decrease R shoulder pain, independent with ADLs, drive, walk

Outcome Measures

<table>
<thead>
<tr>
<th>Body Structure/Function</th>
<th>Activity Limitations</th>
<th>Participation Restrictions</th>
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</thead>
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<tr>
<td>AROM</td>
<td>Modified Functional Reach Test</td>
<td>WHOQOL-BREF</td>
</tr>
<tr>
<td>PROM</td>
<td>Functional Independence Measure (FIM)</td>
<td></td>
</tr>
<tr>
<td>MMT</td>
<td>Barthe Index</td>
<td></td>
</tr>
<tr>
<td>Sensory</td>
<td></td>
<td></td>
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</tbody>
</table>

Interventions
Elementary Backstroke
Single Arm Backstroke
Abdominal Crunches
Oblique Swings
Wall Stands
Sitting Balance

Results

<table>
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<td>Sensory</td>
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</tbody>
</table>

References

Discussion
Clinically significant results
- Right Shoulder Abduction (53 degree increase)
- Sitting Balance for MFRT
- Sensory Neurological Level
- Neck Flexor, R and L Neck Lateral Flexors, R Shoulder Abduction, R Triceps, R Finger Flexor Strength

Potential Reasons for Decline
- Decline in Caregiver’s Health
- Lack of Transportation
- Subject’s Decision to Change from Manual WC to Power WC

Conclusion
Aquatic therapy can be an effective intervention option in rehabilitation for patients with SCI.

Further Research
- Effect on Spasticity
- PT and Aquatic Therapy

Limitations
- Small Sample
- Only Aquatic Therapy
- Lack of Research
The Effects of a Community Based, Multimodal Exercise Program on Sleep Quality in Breast Cancer Survivors

James Blackwell, Mark Cebul, Mindy Hickman, Michael Smith, *Michael Foley
Department of Physical Therapy, Georgia Regents University, Augusta, GA, USA

INTRODUCTION

- Cancer and its treatment can have negative repercussions on sleep quality in breast cancer survivors.
- Decreased sleep quality post cancer diagnosis is linked to fatigue, sleep disturbances, psychological dysfunction, and impaired quality of life.
- The purpose of this pilot study was to examine the effects of a community-based, multimodal exercise program on sleep quality in breast cancer survivors.

METHODS

Subjects:
- 60 breast cancer survivors enrolled in the program and 50 breast cancer survivors completed the program (83.3%).
- 91.5% female
- Mean age: 59 ± 12 yrs (range: 28-82 yrs)

Procedures:
- Outcome measure: Pittsburgh Sleep Quality Index (PSQI)
- Performed pre-post (paired t-tests)

RESULTS

PSQI and Domains Outcome Measures

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>95% CI</th>
<th>Range</th>
<th>n</th>
<th>P value (two tail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Sleep Disturbance</td>
<td>1.64</td>
<td>0.48</td>
<td>0.5 to 0.8</td>
<td>1 - 2</td>
<td>39</td>
<td>0.02*, t = 2.45</td>
</tr>
<tr>
<td>Post Sleep Disturbance</td>
<td>1.44</td>
<td>0.5</td>
<td>1.3 to 1.6</td>
<td>1 - 2</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Pre-Days of Dysfunction</td>
<td>1</td>
<td>0.76</td>
<td>0.8 to 1.2</td>
<td>0 - 3</td>
<td>39</td>
<td>0.01*, t = 2.63</td>
</tr>
<tr>
<td>Post-Days of Dysfunction</td>
<td>0.69</td>
<td>0.61</td>
<td>0.5 to 0.9</td>
<td>0 - 3</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Pre-Sleep Quality</td>
<td>1.07</td>
<td>0.77</td>
<td>0.8 to 1.3</td>
<td>0 - 3</td>
<td>39</td>
<td>0.000*, t = 4.02</td>
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<tr>
<td>Post-Sleep Quality</td>
<td>0.67</td>
<td>0.7</td>
<td>0.5 to 0.9</td>
<td>0 - 2</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Pre-PSQI Total</td>
<td>7.9</td>
<td>4.3</td>
<td>6.5 to 9.2</td>
<td>1 - 17</td>
<td>39</td>
<td>0.001*, t = 3.79</td>
</tr>
<tr>
<td>Post-PSQI Total</td>
<td>6.1</td>
<td>3.9</td>
<td>4.8 to 7.4</td>
<td>1 - 15</td>
<td>39</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

- Clinimetric data showed "moderate to large" effect size improvement for sleep quality and "small to moderate" effect size for sleep disturbance, days of dysfunction, and PSQI total.
- Research indicates a significant relationship between physical activity and sleep in individuals with cancer (Courneya et al,2014; Mishra et al, 2012; Humpel et al, 2009).
- Direct comparison is difficult because of varying exercise programs, sleep assessment tools, and types of cancer. A common belief, though, is that moderate or vigorous intensity exercise tends to result in more positive effects on sleep quality over a similar mild intensity exercise program (Courneya et al, 2014; Friedenreich et al, 2014; Mishra et al, 2012).

APPLICATIONS, LIMITATIONS, FUTURE RESEARCH

Applications:
- The development and refinement of therapeutic exercise programs for improving sleep quality in breast cancer survivors.

Study limitations:
- In this quasi experimental single-arm study no control group was utilized for comparison, resulting in time being the independent variable.
- Randomized controlled design may be warranted.

Future Research:
- Larger population
- Longer study time
- Specific studies
- Additional outcome measures with focus on objectivity
- Investigate causal factors for decreased sleep quality (increased stress or pain)
Distraction and After-effects on an Inclined Stance
Asheeba Baksh, Alyssa Bryant, Mollie McGowan, Calvin McMillan, Raymond Chong
Georgia Regents University, Department of Physical Therapy, Augusta, GA

Introduction

- The ability to maintain balance in all aspects of life is a crucial piece to being able to function independently.
- Balance is controlled by 3 body systems: visual system, vestibular system, and somatosensory system.
- No two people rely on the systems in the same exact way.
- Following a prolonged stance on an inclined surface, subjects exhibit a lean after-effect (LAE) 1.
- The LAE is more substantial when the subjects eyes are closed versus when they are open 2.
- It has been shown that some subjects exhibit the LAE while others do not – meaning that people rely on different body systems for balance 3.
- Numerical cognitive tasking decisions compete for the same neural pathways in the brain as balancing, thus hindering balance ability 3.
- Kluzik and colleagues showed that the after-effect was abolished when subjects were told “stand vertical”, suggesting that the instructions influenced their reaction to the inclined stance 4.
- Our study aimed to expand upon former studies about balance in order to further pinpoint how balance is maintained.

Methods and Results

- 34 subjects were responders and 6 subjects were non-responders.
- If subjects lean the same amount in both baseline and retro conditions, the initial LAE is a result of the inclined stance.
- Not every subject was aware of leaning.

Post-Incline Postural Effects

- Distraction decreases postural adaptation to the inclined stance.
- Initial forward lean is similar in both conditions (distraction vs. no distraction).
- At the end of 180 seconds, responders resumed upright stance when they were not distracted, but they remained leaning when distracted.
- Therefore, the span (range of lean) was also smaller in the distraction condition (*p<0.012).

Conclusions

- Results of this study suggest that the distraction task used effectively distracted the subjects.
- Subjects leaned the same amount in both conditions, suggesting that the initial after-effect is truly from the inclined stance.
- The initial LAE is a subconscious effect, with no voluntary component.
- Distraction decreased postural adaptation to the inclined stance.
- In the absence of distraction, part of the postural adaptation to inclined stance appears to be voluntary, as suggested by Kluzik and colleagues in 2005 1.
- Since many subjects were not aware of their forward lean, the voluntary action may be subconscious or is not in memory 4.

Subjects

- A convenience sample of 40 healthy subjects.
- 20 men and 20 women.
- Average age = 25.275 ± 2.219.
- Reporting no significant neurological or musculoskeletal impairments.

Annexes


Project Objectives

1. To determine if concurrent distraction will diminish the postural after-effect adaptation following a prolonged incline stance.
2. To determine whether non-leaners are somatosensory dominant or if they can consciously correct their forward posture while concurrently performing a numerical cognitive task.

Distraction did not affect the initial after-effect, but did affect the later part.
Driving Training in Individuals with Relapsing-Remitting Multiple Sclerosis: An Ongoing Study

Heather Hagler, Megan Patton, Miriam Cortez-Cooper, Abiodun Akinwuntan, Hannes Devos
Department of Physical Therapy, Georgia Regents University, Augusta, GA

INTRODUCTION

• MS may cause visual, cognitive, and/or physical deficits that can affect driving performance.1
• The most common form is RRMS.2
• Driving is a complex activity that requires involvement of skills in those 3 domains.3
• Previous research showed that contextual, task-oriented training is better than non-contextual, cognitive training to improve driving abilities following stroke.4
• No study compared the two types of training methods in IWMS

PURPOSE

• The aim of our study was to compare contextual training via the driving simulator vs. non-contextual training via cognitive tasks on the Wii in IWMS.

METHODS

• 2 groups: experimental group (simulator training) & control group (Wii training).
• Pre & post-training assessments included cognitive, physical, visual, & on-road driving.
• 5 hours of training (1 hr/wk, 5 wks)
• Simulator group: 10 scenarios training different aspects of driving
• Wii training group: warm-up, 30 minutes Wii exercise training cognitive, physical, & visual skills, & cool-down

RESULTS

• Both groups improved in most neuropsychological tests from pre- to post-training within & between groups (Figures 1-5).
• The simulator group improved in on-road performance while the Wii group’s performance worsened (Figure 6). Only one subject in the simulator group performed the post-training on-road evaluation.
• The Wii group spent more total time training than the simulator group (Figure 7). This did not translate to better results in the on-road evaluation.
• Table 1 shows the difference in mean improvements in each group for the neuropsychological tests & on-road evaluation.

CONCLUSION

• This is an ongoing study; no concrete evidence that one training is superior to the other.
• Initial analysis of the data appears to favor driving simulator training above Wii training for improvement in the on-road evaluation & some cognitive assessments.
• Continuation of this study is needed to allocate enough participants to determine if one training is superior over another.

REFERENCES


This poster design is adapted from “Therese J. Ferguson, L. Chong, R. Lee, and Claudia Czokadlo Effect of 6-week aquatic exercise training on postural control and quality of life in Parkinson’s disease” located at http://www.georgiahealth.edu/alliedhealth/pt/research.html

Abbreviations
MS = Multiple sclerosis, RRMS = relapsing remitting MS, IWMS = individuals with MS, EDSS = expanded disability severity scale, NMSS = mini mental state exam, UFOV = Useful Field of View, PS = processing speed, DA = divided attention, SN = selective attention, Risk Category 1. = very low risk, 2. = low risk, 3. = moderate risk, 4. = moderate high risk, 5. = high risk.
Validation of the predictors of driving for individuals with Multiple Sclerosis
Ashley Henry, BS; Kalie Worley, BS; Hannes Devos, PhD, DRS; Abiodun Akinwuntan, PhD, MPH, DRS
Department of Physical Therapy, Georgia Regents University, Augusta GA, USA

Background
• Limited clinical use of screening tools to determine on-road driving performance in multiple sclerosis (MS) population
• Currently used tools involve 15 or more physical, visual, and cognitive tests
• These evaluations typically cost more than $500 and take longer than 3 hours to complete
• A previous study found that a battery of 5 cognitive tests predicted on-road performance of individuals with MS with 91% accuracy, 70% sensitivity, and 97% specificity

Objective:
• To validate the predictive accuracy of 5 cognitive tests that predicted the driving performance of individuals with MS with 91% accuracy

Methods
Participants:
• Active drivers with MS and a valid driver’s license
• Original study: 44 participants recruited from MS Center at GRU
• Validation study: 58 participants recruited from Shepherd Center in Atlanta

5 Cognitive Tests
- UFOV
- Directions (D)
- Stroop
- Compass (C)
- Road Sign Recognition (RSR)

Prediction Equations
• Pass Equation:
  \[(\text{Stroop} \cdot 0.50) + (\text{Dir} \cdot 2.32) + (\text{Comp} \cdot 0.28) + (\text{RSR} \cdot 0.41) + (\text{UFOV-speed of processing} \cdot 0.21) = 57.24\]

• Fail Equation:
  \[(\text{Stroop} \cdot 0.44) + (\text{Dir} \cdot 2.50) + (\text{Comp} \cdot 0.18) + (\text{RSR} \cdot -0.25) + (\text{UFOV-speed of processing} \cdot 0.22) = 57.11\]

Main Outcome
Pass/Fail Practical On-road Test

Results
Participant Comparisons:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Original</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>0.12</td>
<td>0.07</td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.42</td>
<td>0.02</td>
</tr>
<tr>
<td>MALE</td>
<td>0.42</td>
<td>0.0001</td>
</tr>
<tr>
<td>EDSS</td>
<td>0.07</td>
<td>0.0001</td>
</tr>
<tr>
<td>MS YEARS</td>
<td>0.60</td>
<td>0.50</td>
</tr>
<tr>
<td>DRIVE EXP</td>
<td>0.42</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Abbreviation Key:
- EDSS: Expanded Disability Status Scale
- MS YEARS: Years since diagnosis of MS
- DRIVE EXP: Driving Experience (years)

Discussion
• The battery of 5 tests appears to be a valid predictor of fitness-to-drive of patients with MS and is better at predicting those who will pass
• Low positive predictive value found may be due to differences between original and validation samples
• The battery of five cognitive tests should be used only to screen for individuals with MS who should proceed to perform the on-road test without additional evaluations
• Future studies may look at subgroups of MS

Reference

Acknowledgements
This study was supported by a grant from the National MS Society. The authors also acknowledge the contributions of Erin Neal, BS during conduction of the study and data acquisition.
The Effect of Hippotherapy on Children with Sensory Integration Disorders and Tactile Defensiveness: A Case Series

Takiya Grant, BS; Mary Hagood, BS; Alisa Malte, BS; Lori Bolgla, PT, PhD, ATC; Claudia Morin, MHE, HPCS, OTR/L

Background
For many decades, hippotherapy has been used as a treatment strategy for adults and children with various neuromuscular and musculoskeletal problems. According to the American Hippotherapy Association, hippotherapy is defined as a “physical, occupational, and speech-language therapy treatment strategy that utilizes equine movement as part of an integrated intervention program to achieve functional outcomes.” Hippotherapy is a commonly used strategy to help individuals with sensory integration deficits leading to tactile defensiveness, balance deficits, and impaired fine/gross motor planning. The horse’s movement provides ongoing sensory input for which the participant must process while performing various tasks aimed at addressing these impairments.

Purpose
The purpose of this case series was to determine the effectiveness of a 10-week hippotherapy program on 3 children with varying degrees of impairments associated with sensory integration disorders.

Participants
- Participant 1: 4-year-old male with pervasive developmental disorder; 1st impairments: communication and tactile defensiveness
- Participant 2: 10-year-old female with autism and Wolff-Parkinson-White Syndrome; 1st impairments: coordination, core strength, and reactive timing
- Participant 3: 9-year-old female with autism, muscular dystrophy, obsessive compulsive disorder, and anxiety; 1st impairments: balance, tactile defensiveness, and overall weakness

Intervention
- 45-minute weekly sessions for 10 weeks
- Sessions individually designed and implemented by a NAHRA-certified occupational therapist
- Sample activities with the horse in stance or while walking in various directions:
  - Rapper Snapper
  - Ball Tossing
  - Rings-on-Pole
- Emphasis for each participant to maintain good trunk control during all activities

Outcome Measures
- Short Sensory Profile (SSP)
  - Total score (up to 190) of a 38-item questionnaire designed to provide an overall picture of a child’s performance with sensory processing, modulation, and behavioral and emotional responses
- Timed Up and Go (TUG)
  - Average time of 3 trials to walk 6 meters, expressed to the nearest 1/10th of a second, to assess general mobility and balance

Results

![Short Sensory Profile](image)

Note that Participant 3 did not complete the post-intervention assessment

Discussion
Although each participant had an increased SSP score, pre- and post-test scores remained in the same standard deviation from the mean. This finding suggested that improvements did not necessarily represent a true change. For the TUG, participants 1 and 2 demonstrated a 5.8 second and 0.1 second improvement, respectively. A time of 5.9 seconds has been reported in Australian children without disability. Our participants continued to have scores suggestive of decreased mobility. Although minimal changes in outcome measures occurred, improvements were observed during the children’s interaction with the volunteers and through subjective parental reports. Therefore, hippotherapy should not represent a “sole” intervention strategy but one used in combination with others.

Acknowledgements
Special thanks to Claudia Morin, MHE, HPCS, OTR/L and the children, parents, and volunteers of Blue Ribbon Riders, Inc.

References
INTRODUCTION

Chronic low back pain (CLBP) referrals are becoming more prevalent and studies have documented increases in physical therapy visits for low back pain. Recent evidence has shown that a treatment-based classification system for patients with low back pain might be effective when treating a patient with CLBP with radiculopathy. A specific pattern of pain response called “centralization” suggests that a patient has a “directional preference” (Flexion or Extension) and would respond well to McKenzie-based exercises to decrease radiculopathy. During the treatment regimen, the patient may present with symptoms that may lead to the diagnosis of multiple sources of low back pain with radiculopathy, or the source of pain may change over time depending on the treatment (i.e. muscle strain). One purpose of this case report is to examine the classification-based treatment for a patient with chronic low back pain that would initially respond to McKenzie-specific exercise in order to relieve radiculopathy. A secondary objective of this case report is to examine a patient’s response to modifications in a treatment regimen in order to alleviate fluctuating symptoms. A treatment program initially incorporating McKenzie-specific exercises and later piriformis syndrome treatment will be discussed throughout this report.

METHODS

Design: Case Report
Case Description
History: The patient was a 65-year-old male who currently works as a newspaper editor. He spends most of his days at a desk in the seated position for extended periods of time. The patient attended outpatient physical therapy one week after he was seen by his physician, with complaints of intermittent right-sided lumbar and right hip pain with radicular symptoms extending to the dorsum of the right foot. The symptoms arose from an insidious onset 6 weeks previous and had progressively gotten worse. The patient stated that his pain was worse in the morning, after he had been sitting for extended periods of time at work, or driving and getting into/out of the car. The patient has several duties at work and occasionally has to lift objects (~25lbs) generally from the ground to waist level. PMH: Hypertension, Type II Diabetes Mellitus

Examination:
Range of Motion
Lumbar: Flexion- 42 degrees; Extension- 12 degrees
Strength
MMTs were between 4/5 and 5/5 and painfree. Bilateral Hip Flexion/Extension: 4/5; R Knee Flexion/4-5

Special Tests
DH-Disc Herniation: PF- Piriformis Muscle Strain; HP-Hip Pathology
Positive- Repeated Lumbar Flexion Test (DH), Straight Leg Raise (LLE) (DH), SLUMP Test (DH), FAIR Test (PF)
Negative- FADDIR Test (HP), Scor Test (HP), SI joint Tests

Evaluation
As evidenced by aforementioned subjective patient complaints, objective data, and functional deficits the patient appears to have symptoms consistent with his medical diagnosis of sciatica caused by a possible disc herniation in conjunction with right hip external rotators (piriformis) tension or strain that could potentially be contributing to his radiculopathy.

RESULTS/OUTCOMES

The NPRS, Active Lumbar Range of Motion (extension), and Oswestry Disability Index were used to evaluate the progress of the patient. Other functional outcome measures; 5 sit-to-stands and stair climbing were examined to determine improvements in functional status and mobility. The patient’s pain ratings on the NPRS decreased from a 5/10 to a 0/10 which were clinically meaningful. These findings can be found in Figure 1 below.

CONCLUSION

This case report provides evidence for a specific treatment regimen used to treat a patient with low back pain and radiculopathy. Based on the presentation of the patient, he received McKenzie-specific exercise initially, but then received exercises to address possible piriforms syndrome caused by muscle injury/strain. The muscle strain was possibly due to repetitive improper lifting/body mechanics. At first, the patient’s symptoms centralized with extension based exercises, but the overall improvements for pain and lumbar extension were not clinically meaningful. The physical therapist modified the treatment regimen to incorporate exercises to treat a different pain source, the piriforms muscle. Strength of evidence is limited to the specifics of this design: a case report.
**INTRODUCTION**

Patellofemoral pain, or PFP is one of the most common lower extremity orthopedic conditions seen in outpatient physical therapy clinics today. Patient pain is most commonly in the anterior knee/patella region that is usually exacerbated during prolonged sitting, squatting, kneeling, or stair climbing. The most common and up to date approach to treatment today focuses on a shift away from quadriceps strengthening and towards a focus on stretching and training musculature of the hip. As with any orthopedic treatment approach, one must determine the cause of the patient’s pain. In this particular case, the patient presented with few deficits to the hip musculature and few biomechanical flaws. After a thorough examination of this patient, a treatment approach focusing primarily on improving quadriceps flexibility was implemented. The purpose of this case is to evaluate the effectiveness of quadriceps flexibility in treating PFP.

**METHODS**

**Case Description**

**History:**

Patient is an 18 year old right hand and leg dominant male athlete with a BMI of 24. The patient complained of 2 years of bilateral knee pain that had gotten significantly worse over the course of the last 6 months. The patient complained of pain at the beginning of exercise, with slight decrease in pain during and after exercise.

**Examination:**

- **Range of Motion**
  - PROM
    - Knee flexion: 130° (Right), 130° (Left)
    - Hip Abduction: 111° (Right), 118° (Left)
    - Hip External Rotation: 148° (Right), 116° (Left)
    - Hip Extension: 130° (Right), 130° (Left)

- **Muscle Strength (HHDD)**
  - Knee extension
    - Right: 101.1 lbs. (5/5 MMT)
    - Left: 101 lbs. (5/5 MMT)
  - Hip Abduction
    - Right: 78.5 lbs. (5/5 MMT)
    - Left: 80.2 lbs. (5/5 MMT)
  - Hip Extension
    - Right: 67.5 lbs. (5/5 MMT)
    - Left: 68.9 lbs. (5/5 MMT)
  - Hip External Rotation
    - Right: 68.4 lbs. (5/5 MMT)
    - Left: 69 lbs. (5/5 MMT)

**Evaluation:**

- Upon completion of the examination, it is noted that the patient has limited bilateral PROM/AROM knee flexion. Strength measurements taken of the hip and quadriceps were all 5/5 strength, with pain during knee extension strength testing. The patient presents with increased lordosis of the lumbar spine as well as anterior rotation of the pelvis. Video analysis of the patients biomechanics during various ADL and sport related activities revealed no significant biomechanical abnormalities. Positive special tests included Ely’s and Thomas test indicating quadriceps and hip flexor tightness.

**Diagnosis:**

- **Medical:** Patellar tendinosis
- **Physical Therapy:** practice pattern 4D; impaired joint mobility, motor function, muscle performance, and range of motion associated with connective tissue

**Prognosis:**

- The patient is expected to show positive outcomes within 6 visits, 2 visits per week. This prognosis is based on expert opinion and evidence of effectiveness of various stretching programs (Davis 2005).

**Interventions:**

- A stretching program was implemented consisting of various stretching exercises focusing primarily on quadriceps and hip flexor musculature. Treatment and exercise sessions were 2 days per week with home stretching program to be completed daily.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Patient education of importance to proper body mechanics and core strength. Introduction to stretching protocol, eccentric loading, and core strengthening.</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Continued stretching program with progression as needed. Introduction of plyometric training.</td>
</tr>
<tr>
<td>Phase 3</td>
<td>Continued stretching program. Advanced plyometric training</td>
</tr>
</tbody>
</table>

**RESULTS / OUTCOMES**

The Kujala Questionnaire, NPRS scoring, and goniometric ROM measurements were used as primary outcome measures. Clinically meaningful improvements were seen in all three measures and are shown in the chart below.

**DISCUSSION**

This patient did not present with any hip weakness or any biomechanical flaws. As a result, an extensive analysis of other possible contributing factors revealed excessive tightness of the patients quadriceps and hip flexor musculature. Outcome measures such as pain and the Kujala Questionnaire showed clinically meaningful changes of improvement when focusing on correcting this abnormality through lengthening the quadriceps musculature.

**CONCLUSION**

There is a consistent lack of evidence supporting quadriceps lengthening as an important focus to patellofemoral pain interventions. In this case report, the patient showed clinically meaningful improvements in pain with a treatment approach focusing on lengthening the quadriceps musculature. This case provides low level evidence for the consideration of all possible causes of PFP including but not limited to quadriceps length. Further research in this area is needed to determine the effectiveness of a stretching program for patients with tight quadriceps musculature with PFP.
Parkinson’s Disease Symptoms and GPR109A: Effects of Niacin

Ashley Strickland, Katie Ward, Chandramohan Wakade, Raymond K. Chong
Department of Physical Therapy, Georgia Regents University, Augusta, GA

Background

• Inflammation is central in the pathogenesis of Parkinson’s Disease (PD) (Wakade, et al., 2014).
• This inflammatory response may contribute to the destruction of mitochondria limiting energy production, oxidative stress in the body, and dopamine depletion in substantia nigra.
• GPR109A levels have been found to be upregulated in patients with PD. Beta-hydroxybutyrate is its physiological ligand. Niacin is a known agonist of this receptor and its levels are depleted in PD. Niacin has a high affinity for beta-hydroxybutyrate. GPR109A is known for its anti-inflammatory role.
• We evaluated if niacin supplementation would normalize levels of GPR109A in white blood cells and improve PD symptoms.

Methods

Subjects

• 3 subjects with PD
• 64 ± 10 years old (range: 53-77 years)
• H & Y: 1.9 ± 0.64
• Mean PD duration: 4.5 years

Procedures

• PD assessments and baseline blood samples were taken before 250mg niacin supplementation, at 3 months with niacin, and at 3 months without niacin.
• PD Quality of Life, PD Sleep Scale, Rapid Assessment of Postural Instability in PD, Unified PD Rating Scale part 3 (clinician-scored monitored motor evaluation).
• Western Blot using ImageJ
• GPR109A levels were normalized to GapDH loading control.

Discussion

• Results are promising given small sample size
• Niacin has the potential to decrease inflammation acting via GPR109A related mechanisms and improvement of PD symptoms
• Optimal dosage level for niacin supplementation
• Larger population sizes
• Increased length of experimental period
• Increased use of objective assessments
• Relationship between GPR109A levels and PD symptoms
• Mechanisms & source of upregulation of GPR109A and related mechanisms of niacin
• Further studies to determine whether niacin has neuroprotective or symptomatic effects

Results

• Niacin supplementation significantly reduced GPR109A levels (p = .046) as seen in the graphs below.

Table 1 summarizes results from the graphs above

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Baseline vs. Niacin</th>
<th>Niacin vs. post</th>
<th>Baseline vs. post</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR109A</td>
<td>(5.8)</td>
<td>(4.3)</td>
<td>(0.77)</td>
</tr>
<tr>
<td>GPR109A normalized to GapDH</td>
<td>(2.0)</td>
<td>(6.6)</td>
<td>(1.80)</td>
</tr>
</tbody>
</table>

A trend shows an improvement in PD motor symptoms (UPDRS 3), quality of life (PD QoL), and sleep quality (PD Sleep Scale) with niacin supplementation as seen in the graphs below.

Table 2 summarizes results from the graphs above

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Baseline vs. Niacin</th>
<th>Niacin vs. post</th>
<th>Baseline vs. post</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPDRS</td>
<td>(2.70)</td>
<td>(0.69)</td>
<td>(0.29)</td>
</tr>
<tr>
<td>Rapid 3</td>
<td>(1.30)</td>
<td>(0.25)</td>
<td>(0.77)</td>
</tr>
<tr>
<td>Rapid 2</td>
<td>(0.44)</td>
<td>(0.21)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>Rapid 1</td>
<td>(0.37)</td>
<td>(0.21)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>PD QoL</td>
<td>(0.30)</td>
<td>(0.51)</td>
<td>(0.31)</td>
</tr>
<tr>
<td>Sleep Scale</td>
<td>(0.16)</td>
<td>(3.70)</td>
<td>(0.27)</td>
</tr>
</tbody>
</table>

References:

This poster design is adapted from
Scapular Dyskinesia in a Collegiate Swimming Athlete: A Case Report

Sarah Parker, SPT, ATC

Department of Physical Therapy, Georgia Regents University, Augusta, GA

INTRODUCTION
The term “swimmer’s shoulder” has been widely used to describe the myriad of symptoms surrounding shoulder pain in the swimming athlete. This all-encompassing disorder of the scapular stabilizers and supporting structures of the shoulder can be misleading in regards to diagnosis and treatment. Because of the amount of motion and the high amount of repetitions required at the glenohumeral joint for proper stroke execution, the shoulder can become inflamed and the tissues surrounding it may break down. Fatigue of muscle groups that stabilize the scapula lead to scapular dyskinesis. This biomechanical change in dynamic scapular positioning can lead to a reduction in subacromial space, an increased contact force between the posterior-superior labrum, an increased attenuation of the anterior glenohumeral joint capsule, and fatigue of the rotator cuff, which can all lead to a loss of dynamic stability at the shoulder. The purpose of this case report is to examine a comprehensive rehabilitation protocol utilizing research that addresses the patient’s deficits and sport demands.

CASE DESCRIPTION

History:
The patient is a 20 year old right handed female who swims primarily distance butterfly stroke for a Division I collegiate team. She reports a gradual onset of right shoulder pain beginning in January 2014. She saw her team athletic trainer for the remainder of her season. She reports no incident of injury. Patient states that the pain increases after two-hour long practices and especially during the pull down phase of the butterfly stroke. The patient had X-rays that showed no problems and the patient has had no prior shoulder problems. The patient states that the majority of her pain is felt deep in the anterolateral shoulder.

Examination:
- Range of Motion in R Upper Extremity (AROM):
  - Shoulder Flexion: 154
  - Shoulder Abduction: 170 (+pain)
  - Shoulder Extension: 68
- Special Tests (Stimson and Tempkin, Alquana et al, Michener et al.):
  - O’Brien Test: Positive
  - Empty Can Test: Positive
  - Hawkins-Kennedy Test: Negative
  - Neer’s Impingement: Negative

Evaluation:
Examination of her shoulder revealed no gross atrophy or asymmetry from muscular standpoint or swelling standpoint. She does appear to have winged scapulae bilaterally. She denies any cervical pain or feelings of neuropathic pain. She has pain with active abduction of the shoulder and decreased strength and pain with shoulder extension, abduction, and rotation. The patient experiences most difficulty with participating in swim practice. Her pain ranges from 0/10 at rest to 3-4/10 after practice. She is not tender to palpation.

Diagnosis:
- Medical: R Subscapularis Tendinitis
- Physical Therapy: practice pattern 4E: Impaired Joint Mobility, Motor Function, and Range of Motion Associated with Localized Inflammation ; ICD-9 Code 840.7 Superior Glenoid Labrum Lesion due to positive O’Brien test and clinical examination

Prognosis:
The APTA Guide expected range of visits is 6-24 for this practice pattern. Based on the Fedorow et al. 2014, study the expected number of visits are 16 over 8-12 weeks.

Interventions:
Phase 1 consisted of exercises directed towards decreasing the patient’s pain and symptoms, which included stretching and prone scapular stabilization. At the beginning of phase 2, the patient demonstrated decreases in outcome measures and no significant improvement in symptoms. This change was unexpected, and therefore led the therapists to examine a change in the focus of treatment from glenoid labral pathology to potential scapular dyskinesia as a cause for symptoms. Exercises added included the Body Blade, rhythmic scapular stabilization, plyometric exercise, and eccentric exercises.
Phase 3 was implemented as an exercise progression due to the patient returning to school. These exercises increased in intensity and attempted to simulate the demands required of the athlete as she returned to full competitive swim practice. The exercises included in this progression included prone rhythmic stabilization, the addition of perturbation, and functional patterns incorporated in to certain exercises.

OUTCOMES

Active ROM measurements were taken throughout the patient’s course of treatment. There were gains initially, but over time these gains became within normal limits as compared to the uninvolved extremity. The FOTO® was utilized as a measure of the patient’s functional status. At initial evaluation, the patient reported her symptoms as a 75/100. The patient’s score decreased at the second evaluation point to 73/100. At the final evaluation, the patient scored an 88/100. This change has been found to be a clinically meaningful improvement for the patient’s shoulder function. The DASH score showed improvement with a decrease from 43 to 34. The 9 points of physical change was not deemed to be clinically meaningful, however this could be due to providing the DASH score to the patient at the midpoint of therapy rather than at initial evaluation. The special tests were all found to be negative at discharge, thus suggesting the labral problem was not the primary pathology. The patient also had decreased observable scapular winging, symmetrical scapular movement, and the ability to maintain proper exercise positioning.

DISCUSSION

The patient responded favorably to scapular stabilization training, achieving clinically important changes, without associated exacerbation of symptoms. The therapists believe that this research sheds light on the need for more research into the field of the swimmer’s shoulder and the development of a functional outcome measure specific to swimming athletes. The limitations of this study include an initial lack of awareness of scapular involvement and a lack of consistently performed outcome measures. This case study is not an experimental design that can evaluate cause for improvement or a design that can show correlations. This case report is simply an example of a single patient who appeared to benefit from specific scapular stabilization exercises.

CONCLUSION

This case report provides preliminary, albeit low-level evidence that the use of dynamic scapular stabilization through targeting specific muscle groups may be beneficial for improving shoulder pain in an elite swimmer. It is evident that further research is warranted in this area with larger populations and randomized control designs.
Non-Operative Rehabilitation for Shoulder Instability:  
A Case Report  
Scott Arnold, SPT  
Department of Physical Therapy, Georgia Regents University, Augusta, GA

INTRODUCTION
Shoulder instability is defined as excessive translation of the glenohumeral joint and is a relatively uncommon pathology, affecting approximately 2% of the population (Sciascia et al., 2012). This condition has a wide variety of classifications and divisions, based on the mechanism of injury, age of the patient, and outcomes from examinations. Conservative treatments, such as physical therapy, muscle strengthening, and body mechanic improvement, are less frequently chosen than more invasive methods, such as a bone iliac graft or a complete shoulder arthroplasty. Currently, there is little research examining non-operative treatment of traumatic shoulder instability. A concept paper by Wilk, Macrina and Reinold describes a protocol to address instability without surgery. The focus of this case report was to examine the efficacy of the concept paper and to provide limited proof (or lack there of) for the proposed interventions described by the authors. The treatment performed during this case report was modeled from the recommendations made in this concept paper, with minor alterations made due to time constraint.

METHODS

Case Description
History:
The patient was a 27-year-old right hand dominant male who was referred to physical therapy with a medical diagnosis of shoulder pain. The mechanism of injury involved a violent fall in which he hit the ground with his right shoulder caught in full external rotation and abduction, approximately one year prior to his referral to physical therapy. Upon injury, the patient’s physician had ordered x-rays, but determined that there was no sign of fracture and did not pursue treatment. Over the next few months, the patient noticed a “clicking” and “popping” sensation deep in his shoulder joint. Pain continued to worsen, especially while reaching overhead and behind his back, and had begun to affect his job. The patient’s chief complaint was pain and inability to use his right arm, reporting apprehension due to fear of his condition worsening. The patient also reported difficulty sleeping due to pain in the shoulder. The patient denied any additional medical problems upon examination.

Examination:
• Active Range of Motion (ROM)
  • Involved/uninvolved/normative value
  • Flexion: 143/174/130
  • ER: 46/55/70
  • IR: 62/81/90
  • Abduction: 132/162/180
• Shoulder Pain & Disability Index (SPADI)
  • Initial Score = 52/100
• NPRS
  • 9/10 right shoulder at worst
• Disabilities of the Arm, Shoulder & Hand (DASH):
  • Initial Score: 48/100

Evaluation:
Upon completion of the examination, the patient demonstrated limited ROM of the R shoulder and presented with poor posture in sitting and standing. The SPADI and DASH outcome scores reflected a significant amount of pain and functional disability, and (+) results from the Prehension/Relocation, Jerk, and Crank tests.

Diagnosis:
• Medical: Right shoulder instability


Prognosis:
The patient was seen for 7 weeks; 2 times per week for 30 minute treatment sessions for a total of 14 visits, and was expected to show positive outcomes throughout treatment.

Interventions:
• Table 1 below shows a summary of each of the 3 phases used in the treatment protocol performed.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Exercise</th>
<th>Extremity</th>
<th>Weight/Level</th>
<th>Reps</th>
<th>Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SCIF Pre II</td>
<td>BI</td>
<td>Ly. 2</td>
<td>8 minutes</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>PROM: ER</td>
<td>Right</td>
<td>N/A</td>
<td>30 seconds</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>PROM: Abduction</td>
<td>Right</td>
<td>N/A</td>
<td>30 seconds</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>Standing Pendulum</td>
<td>Right</td>
<td>N/A</td>
<td>minutes</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>Standing ER</td>
<td>Right</td>
<td>N/A</td>
<td>12 reps</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>Electric Stimulation</td>
<td>Right</td>
<td>N/A</td>
<td>8 minutes</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase</th>
<th>Exercise</th>
<th>Extremity</th>
<th>Weight/Level</th>
<th>Reps</th>
<th>Sets</th>
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<tr>
<td>Phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SCIF Pre II</td>
<td>BI</td>
<td>Ly. 4</td>
<td>8 minutes</td>
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<tr>
<td>2</td>
<td>Pulley</td>
<td>BI</td>
<td>N/A</td>
<td>3 minutes</td>
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<tr>
<td>2</td>
<td>AAROM T-Bar</td>
<td>Right</td>
<td>N/A</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>ER in Saddle</td>
<td>Right</td>
<td>N/A</td>
<td>13</td>
<td>3</td>
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<tr>
<td>2</td>
<td>Extension in Prone</td>
<td>Right</td>
<td>1 lb.</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Flexion in Prone</td>
<td>Right</td>
<td>1 lb.</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Abduction in Prone</td>
<td>Right</td>
<td>1 lb.</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Ice Application</td>
<td>Right</td>
<td>N/A</td>
<td>8 minutes</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Electric Stimulation</td>
<td>Right</td>
<td>N/A</td>
<td>4 minutes</td>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase</th>
<th>Exercise</th>
<th>Extremity</th>
<th>Weight/Level</th>
<th>Reps</th>
<th>Sets</th>
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<tr>
<td>Phase</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>SCIF Pre II</td>
<td>BI</td>
<td>Ly. 6</td>
<td>8 minutes</td>
<td>1</td>
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<tr>
<td>3</td>
<td>TheraBand ER</td>
<td>Right</td>
<td>Yellow</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TheraBand IR</td>
<td>Right</td>
<td>Yellow</td>
<td>20</td>
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<tr>
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<td>TheraBand IR</td>
<td>Right</td>
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<td>20</td>
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<tr>
<td>3</td>
<td>TheraBand IR</td>
<td>Right</td>
<td>Yellow</td>
<td>20</td>
<td>3</td>
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<tr>
<td>3</td>
<td>TheraBand IR</td>
<td>Right</td>
<td>Yellow</td>
<td>20</td>
<td>3</td>
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<tr>
<td>3</td>
<td>TheraBand IR</td>
<td>Right</td>
<td>Yellow</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Wall Dribbles</td>
<td>Right</td>
<td>N/A</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Ice Application</td>
<td>Right</td>
<td>N/A</td>
<td>8 minutes</td>
<td>1</td>
</tr>
</tbody>
</table>

RESULTS/OUTCOMES

The DASH, SPADI, Active Range of Motion (flexion/extension) and Numeric Pain Rating Scale were used to evaluate the progress of the patient. See Figure 1 for results and extrapolated time to perfect “zero” score of outcome measures:

- DASH scores: 48/100, 33/100, 13/100. (MCID: 10.83 points)
- SPADI total scores: 52/100, 34/100, 19/100. (MCID: 13 points)
- NPRS scores: 9/10, 6/10, 3/10 (MCID: 2 points)
- ROM changes: flexion: 33°, IR: 16°, ER: 19°, abduction: 41° (MCID: 15°)

DISCUSSION
The patient responded well to the treatment protocol recommended by Wilk, Macrina & Reinold. The patient demonstrated clinically significant reductions in pain and functionality, meeting the MCID for all outcome measures used. Normative values for the DASH questionnaire, determined as <15: no problems; 16-40: problem, but working; and >40: unable to work) place the subject in the "no problem" category following treatment with a final score of 13. Unfortunately, there have been no normative values determined for the SPADI. However, in regards by the MCID of the SPADI (13 points), the patient made clinically meaningful changes following treatment. Pain was still within the "mild" range, and made clinically significant reductions, although still present. ROM and pain made clinically meaningful changes as well, meeting the criteria determined by the MCID.

CONCLUSION
This case report provides low-level evidence proof of efficacy supporting the rehabilitation recommended in the concept paper written by Wilk, Macrina, & Reinold. This protocol may be beneficial for improving pain, ROM, and functionality in patients with shoulder instability. However, future case reports using this protocol should address the limitations of this study, particularly the time constraint, with only 7 weeks allotted for full treatment. The authors of the concept paper recommended 4 phases of treatment, but due to time constraints, phases III and IV were combined. Future studies should follow the phases more distinctly with a greater amount of time allowed for each phase. Outcome measures showed clinically meaningful changes throughout treatment; however, the outcome measures were taken before the start of Phase I, the beginning of Phase II, and upon discharge. Therefore, we were unable to determine specifically which phase of treatment was most beneficial, and future case reports on this subject should take outcome measures more frequently. In addition, due to the inconsistency of patient presentation with worst reported pain, there is a possibility the patient was catastrophizing, and therefore skewed the data.
Case Evidence for a Post-Surgical, Type II SLAP Lesion Rehabilitation Protocol: A Case Report
Christopher Carter, SPT
Department of Physical Therapy, Georgia Regents University, Augusta, GA

INTRODUCTION

A superior labrum anterior to posterior (SLAP) lesion involves an anterior to posterior tear of the superior labrum of the glenohumeral joint. The main goals of SLAP lesion surgical repair are to obtain the strongest repair that allows the patient to participate in an aggressive rehabilitation process and to return the patient to the prior level of function and full activity. The purpose of this 8-week case report is to provide case evidence for a developed rehabilitation rationale concept for a post-surgical type II SLAP lesion repair involving flexibility training, glenohumeral and scapular stabilizer strengthening, proprioceptive neuromuscular activation pattern, manual therapy for capsular tightness, and patient education to examine outcome responses.

METHODS

History

The patient is a 40 year old right-hand dominant female referred to physical therapy with orders to evaluate and treat a right shoulder superior labrum anterior to posterior repair. The medical history revealed no systemic co-morbidities. The mechanism of injury involved a forceful fall onto an outstretched hand with the arm abducted to 90° and slight external rotation. Surgery correcting the SLAP lesion was conducted 1.5 weeks after the initial fall, and physical therapy was initiated two days after the corrective surgery.

Examination

- Pain at an average of 7 of 10 NPRS with movement in all planes involving right shoulder primarily related to post-surgical pain
- Decreased range of motion in right shoulder for flexion, abduction, internal rotation, and external rotation
- External rotation in her right shoulder was most limited
- Decreased strength of glenohumeral and scapular stabilizer muscles in right shoulder by 44% measured with hand-held dynamometry in comparison to age and gender related normative values for healthy females

Evaluation

- Upon completion of the examination, it was noted that the patient had decreased strength, and limited PROM of the right shoulder with pain present in all planes. At the activity level, the patient had severe difficulty with ADLs at home. At the participation level, the patient experienced extreme interference of social activities and work duties, in addition to other community activities and was unable to play recreational tennis

Case Description

The patient is a 40 year old right-hand dominant female referred to physical therapy with orders to evaluate and treat a right shoulder superior labrum anterior to posterior repair. The medical history revealed no systemic co-morbidities. The mechanism of injury involved a forceful fall onto an outstretched hand with the arm abducted to 90° and slight external rotation. Surgery correcting the SLAP lesion was conducted 1.5 weeks after the initial fall, and physical therapy was initiated two days after the corrective surgery.

diagnosis

- Medical: Superior labrum tear following anterior to posterior (SLAP lesion)

prognosis

- This demonstrates a very broad prognosis for a heterogeneous patient population consisting of soft tissue surgeries. Prior rehabilitation rationale concepts focusing on Type II SLAP lesions suggest following a 21-26 week protocol (Manske et al., 2010).
- I believe that the patient will demonstrate major improvements in function, pain control, strength, and range of motion during the 8 week time period that encompasses this case report

Interventions

- Patient Education
  - Home-exercise program, instruction on surgical procedure performed and guidelines/precautions to follow, and postural awareness
- Stretching/Flexibility
  - Therapeutic stretching to increase flexibility of the posterior capsule of the shoulder, and to lengthen other shortened muscles of shoulder for optimal length/tension relationship
- Manual Therapy
  - Therapist-assisted stretching and joint mobilizations for static/dynamic shoulder stabilizer flexibility, and pain control
- Strengthening
  - Muscle strength and endurance to develop a balance demonstrated between the scapular stabilizers, the rotator cuff, and the non-contractile tissues of the shoulder.
- Modalities
  - Ice for decreasing pain and inflammation to augment physical therapy exercises

Phase 1 - Maximum Protection Phase

- Weeks 0-2: Pendulums; Scapular Squeezes; Therapist-Assisted ER/IR Stretch; Joint Mobilizations Grade I (Ant/Post)
- Weeks 2-4: Scapular Squeezes; Isometrics (Flx/Abd/IR/ER); Submax Scapula (All Planes); Posterior Capsule Stretch; Therapist-Assisted ER/IR/Fix/Abd Stretch; Joint Mobilizations Grade II (Ant/Post)
- Weeks 4-6: Prone Extension; AROM (Flx/Abd/IR/ER); Posterior Capsule Stretch; Therapist-Assisted ER/IR/Fix/Abd Stretch; Joint Mobilizations Grade III (Ant/Post)

Phase 2 - Moderate Protection Phase

- Horizontal Abduction; Standing Retraction; Standing Isometric (Flx/Abd/IR/Scap); Serratus Punch; Prone Row; Posterior Capsule Stretch; Therapist-Assisted ER/IR/Fix/Abd Stretch; Joint Mobilizations Grade III/IV (Ant/Post)

RESULTS / OUTCOMES

- Reduction in pain from the baseline - 7/10 initially to a 2/10 at the end of week 8. Not pain-free at the end of week 8
- Improvement in function – QuickDASH initially a 77/100 to a 39/100 at the end of week 8. Did not achieve full functional independence denoted by a QuickDASH score of 25/100
- Improvement in strength in the affected upper extremity – In comparison to age and gender related normative values, the patient demonstrated a 44% strength deficit in the initial examination to an average 19% strength deficit at the end of week 8

DISCUSSION

- The patient responded favorably to the treatment plan. An inverse relationship appeared to exist between pain and hand-held dynamometry strength testing where the largest increase in strength was seen concurrently with the largest reduction in pain. The reduction in pain from weeks 0-6 (7/10 NPRS to a 3/10 NPRS) was most likely due to healing. The largest improvement in function was seen from initial examination to the week 2 re-evaluation, and could be due to decreased apprehension. The limitations of the case report are: 1) Endurance of periarticular and glenohumeral musculature was not tested using outcome measures; 2) Hand-held dynamometry strength of the non-affected upper extremity was not checked at the end of week 8; and 3) Outcomes had to be assessed before the entire treatment plan was finished

CONCLUSION

- This case report is low-level evidence proof of concept for a rehabilitation program for post-surgical, Type II SLAP lesions. This program may prove beneficial for improving pain, ROM, strength, and function. The patient demonstrated minimally clinically important differences from evaluation to the 8-week re-evaluation in all outcome measures. Additional treatment should focus on obtaining flexibility in the posterior capsule of the affected shoulder for proper shoulder biomechanics
Patients with Vestibular Dysfunction Use Somatosensory-Dominant Strategies for Postural Adaptation After Incline Stance

Brian Berl, Brian Cook, Paul Turner, Kyle Walker, Raymond K. Chong, PhD
Department of Physical Therapy, Georgia Regents University, Augusta, GA

BACKGROUND & PURPOSE
Postural Control is a combination of motor and sensory processes relying on the visual, somatosensory, and vestibular systems\(^1\)

Vestibular disorders can affect an individual’s sense of movement, visual stability, and ability to maintain balance\(^2\)

Recent research has sought to determine the effects on postural control of standing on an incline surface with eyes closed

After returning to a horizontal surface, a continuum of responses across subjects ranged from a large lean in the direction of the incline to an upright alignment\(^3\)

The authors proposed that the leaners relied more on somatosensory information to maintain upright posture\(^3\)

A gap in the current body of knowledge exists in how patients with vestibular disorders control posture

The purpose of this study is to determine how patients with vestibular disorders compare to age matched controls in maintaining balance without visual input

We want to determine if patients with vestibular disorders rely more on the somatosensory system to maintain posture than individuals without a vestibular disorder

We hypothesize that individuals with vestibular disorders will rely more on the somatosensory system to maintain balance

METHODS

SUBJECTS

Total Subjects: 24

Inclusion Criteria: Subjects diagnosed with a vestibular-related condition

Exclusion Criteria: Subjects presenting with vestibular symptoms prior to testing on test day; unable to stand with eyes closed

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<th>Quantity</th>
<th>Age Range</th>
<th>Mean Age</th>
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<td>33-58</td>
</tr>
<tr>
<td>Control</td>
<td>12</td>
<td>27-50</td>
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</table>

Information Regarding Subjects’ Vestibular Dysfunction

<table>
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<tr>
<th>Episodic Recurrent Vertigo</th>
<th>Meniere’s Disease</th>
<th>Dizziness</th>
<th>Vestibular Neuritis</th>
<th>Mean/SD</th>
<th>Range</th>
<th>Median</th>
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</table>

Dizziness Handicap Inventory

(0-100, Higher Scores Indicates Greater Severity of Symptoms)

Mean SD Range Median
47.6 26.2 12-80 44

Self-Rated Vestibular Symptoms Pre-Test

(1-10, Higher Scores Indicates Greater Severity of Symptoms)

Mean SD Range Median
2.33 1.73 1-6 2

Assessment Tools

Recruited a purposive sample of patients with vestibular disorders and age matched controls

Each subject received verbal instruction and practiced the procedure outside of the NeuroCom

Each subject was positioned appropriately in the NeuroCom and a safety harness was applied

Each subject was provided a blindfold to ensure no visual processing during eyes closed conditions

After baseline data was collected, each subject performed one three-minute trial on the incline board and on level surface, with data collected in the second trial

Afterward patients then responded to a questionnaire before performing an SOT protocol

RESULTS

Effect of inclined stance

<table>
<thead>
<tr>
<th>Effect of inclined stance</th>
<th>% outcome</th>
</tr>
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<tbody>
<tr>
<td>Positive</td>
<td>25</td>
</tr>
<tr>
<td>Negative</td>
<td>75</td>
</tr>
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</table>

Vestibular

Mean SD Range Median
5 4 2

Control

Mean SD Range Median
4.2 2 2

Figure A

Vestibular severity

Amplitude of forward lean, cm

Mean SD Range Median
3 2 2 1

Figure B

Dizziness Handicap Inventory

Mean SD Range Median
47.6 26.2 12-80 44

Figure C

Figure A. 100% of the vestibular group and 58% of the control group were responders.
Figure B. Increased severity of vestibular symptoms was positively associated with the amount of forward lean, r = 0.84.
Figure C. Graph showing the amplitude of forward lean in the vestibular group. In the graph, patients 1-8 started leaning early and then became more upright; patients 9-12 started more upright and ended leaning forward more.

CONCLUSION

The results suggest that individuals with vestibular disorders exhibit a somatosensory dominance in stance postural control.

Physical Therapists should account for this somatosensory dominance when treating vestibular related loss of balance.

Future research should investigate whether it is better to train somatosensory function or vestibular system to optimize balance in patients with vestibular dysfunction.

References


**INTRODUCTION**

Multiple Sclerosis (MS) affects visuomotor performance and cognitive function.

Previous research supports Wii Fit as a therapeutic tool for improving balance, endurance, and self-confidence in individuals with MS.

Virtual reality exercise provides sensory feedback to meet each individual's needs and challenge their multisystem impairments.

Limited research exists to support Wii Fit as a visuomotor and cognitive intervention for individuals with MS.

**PURPOSE**

To determine if improvements can be made in visuomotor performance and cognitive function in participants with MS after exercise training with the Wii Fit gaming system.

**CLINICAL RELEVANCE**

If proven effective, patients with MS would be able to use Wii Fit gaming system to improve visuomotor and cognitive skills that could improve their ability to perform functional tasks, such as driving.

**METHODS**

Pre-test, post-test quasi-experimental study design

**Subjects**

Three women, all with relapsing, remitting MS and average age of 43.7 years.

**Main Outcome Measures**

On-Road Driving Test

Multiple pen & paper tests of visuomotor and cognitive performance

**INTERVENTION**

Five weekly, 1 hour long Wii Fit training sessions

Games played: Basic Balance, Basic Run, Perfect 10, Ski Jump, Soccer Heading, Triceps Extension

Given HEP after each session.

**RESULTS**

The Effects of Wii Training on Visuomotor Performance and Cognitive Function in Individuals with Multiple Sclerosis

Andrea Orton, BS, Marianna Shackelford, BS, Landon Watters, BS, and Miriam Cortez-Cooper, PT, PhD

Department of Physical Therapy, Georgia Regents University, Augusta, GA

- **On Road Test Score**

  - Figure 1: The 3 subjects showed no significant improvements in the On Road Test indicating no improvements in driving. Each subject scored below the cut-off score (<45) indicating unsafe driving.

- **Useful Field of View Category**

  - Figure 2: The 3 subjects showed improvements in the UFOV Category. Each subject scored a 3 or less on the post-test indicating a moderate to low risk for unsafe driving.

- **Perfect 10**

  - Figure 3: Perfect 10 is an example of a Wii Fit game that challenges visuomotor and cognitive performance. Improvements were greatest for subjects with low initial scores.

- **Soccer Heading**

  - Figure 4: Soccer Heading requires quick processing speed and reaction time. Improvements were greatest for subjects with low initial scores.

**CONCLUSION**

Wii Fit appears to be beneficial for improving visuomotor performance and cognitive function in patients with MS. However, this improvement did not translate to performance during the On-Road Driving Test.

Future research with a larger sample size would further investigate the effectiveness of Wii Fit training in individuals with MS.

**References**