

The Effects of Mental Practice on Balance Dysfunction In Individuals With Multiple Sclerosis

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Outline

- ▶ Multiple Sclerosis
- ▶ Theories/ Mechanisms of Mental Practice
- ▶ Review of Literature and Mental Practice
- ▶ Case Descriptions
- ▶ Examination/Evaluation
- ▶ Intervention
- ▶ Outcomes
- ▶ Discussion/Conclusion

Multiple Sclerosis

- ▶ Disease of CNS involving demyelination of the myelin sheath
 - Autoimmune?
- ▶ **Common S & S**
 - Fatigue**
 - Muscular weakness
 - Gait disturbances
 - Sensory disturbances
 - Visual disorders
 - B&B dysfunction
 - Cognitive impairment
 - Depression
- ▶ **Diagnosis: Clinical**
 - Evidence of plaques/lesions in 2 distinct areas of the CNS
 - Evidence that the plaques occurred at discrete points in time
 - No explanation (other than MS) for the plaques

National Multiple Sclerosis Society. Available at: <http://www.nationalmssociety.org>. Accessed October 8, 2005.

Types of MS

- ▶ **Relapsing-Remitting:** Clearly defined acute attacks (relapses) with full recovery or residual deficit upon recovery
- ▶ **Secondary progressive:** Begins initially as relapsing-remitting, followed by variable progression with minor remission or plateau
- ▶ **Primary progressive:** Progression of disability from onset, without plateaus or remissions
- ▶ **Progressive relapsing:** Progressive disease from onset with clear acute relapses with or without full recovery

National Multiple Sclerosis Society. Available at: <http://www.nationalmssociety.org>. Accessed October 8, 2005.

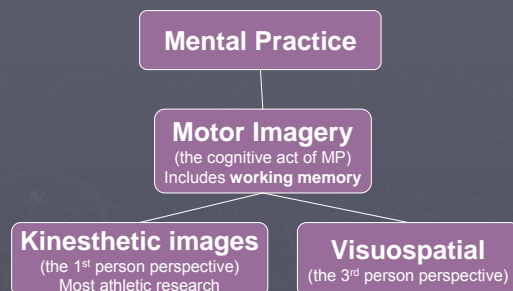
MP– An Introduction

- ▶ **MP-** commonly described as a training method that consists of repeated imagined movements or mental rehearsal with the intention of improving performance and retention of a skill
- ▶ Therapeutic technique

Malouin F, Belleville S, Richards CL, Desrosiers J, Doyon J. Working memory and mental practice outcomes after stroke. *Arch Phys Med Rehabil.* 2004;85:177-83.

Jackson PL, Lafleur MF, Malouin F, Richards C, Doyon, J. Potential role of mental practice using motor imagery in neurologic rehabilitation. *Arch Phys Med Rehabil.* 2001; 82:1133-41.

MP– An Introduction



Malouin F, Belleville S, Richards CL, Desrosiers J, Doyon J. Working memory and mental practice outcomes after stroke. *Arch Phys Med Rehabil.* 2004;85:177-83.

Decety J. The neurophysiological basis of motor imagery. *Behavioural brain research.* 1996; 77:45-52.

MP Mechanisms & Theory

- ▶ Studies have shown that MP and physical practice (PP) of the same activity share a common neural substrate or similar neuromotor pathways
- ▶ **Psychoneuromuscular theory** (most accepted)-- nerve impulses are transmitted to target muscles during MP of a certain movement
 - these impulses facilitate future performance by priming specific "mental nodes" or "patterns of movement"
- ▶ Still unknown, but what does research show?

Jackson PL, Lafleur MF, Malouin F, Richards C, Doyon J. Potential role of mental practice using motor imagery in neurologic rehabilitation. *Arch Phys Med Rehabil*. 2001; 82:1133-41.

Classic MP Research

- ▶ Pascual-Leone et al showed that subjects who mentally practiced a new skill significantly improved performance (NOT as significant as physical practice)
- ▶ MP led to the same plastic changes that were seen in the PP group
- ▶ What could this mean for individuals with MS?

Pascual-Leone A, Dang N, Cohen LG, Brasil-Neto JP, Cammarota A, Hallett M. Modulation of muscle responses evoked by transcranial magnetic stimulation during the acquisition of new fine motor skills. *J Neurophysiol*. 1995;74:1037-45.

MP in Physical Therapy			
CVA	PD	MS	Balance Dysfunction
Yoo et al; 2001 n=3; MP and UE single case series	Cummington et al; 2001 n=6 single case series	Fell; 2000 n=1; Balance and Function case report	Fransler et al; 1985 n=36 randomized control trial
Crosbie et al; 2004 n=10; MP and UE single case series	Fillippi et al; 2001 n=7 experimental design	Fell, Burchay, Brody, Atman; 2002 n=3; MP and Balance case report series	Linden et al; 1989 n=23 randomized control trial
Page et al; 2001 n=1; MP and UE case report			
Dickstein et al; 2004 n=1; MP and Gait case report			
Stevens et al; 2003 n=2; MP and UE single case series			

MS and Mental Practice

- ▶ Minimal published research
- ▶ Mental practice (MP) has been suggested to be effective in the treatment of Parkinson's disease, stroke, and balance dysfunction in the geriatric population
- ▶ Hypothesis: MP is an effective component of treatment for balance dysfunction in patients with MS due to fatigue-related limited physical practice.

Justification for Case Report Series

- ▶ Previous case report suggests potential for application of MP to improve balance in individuals with MS
- ▶ Appropriate due to variable presentation of individuals with MS
- ▶ Controlled group studies are necessary to further evaluate usefulness of MP as a primary intervention and/or adjunct intervention

Case Descriptions

Recruitment:

- From local MS support groups
 - ▶ UTC IRB Approval # 05-083

Inclusion criteria:

1. Diagnosis of relapsing remitting or secondary progressive MS
2. Physician approval for participation
3. Current complaint of balance dysfunction
4. Community ambulator

Case Descriptions

► Exclusion criteria:

- 1) Exacerbation of symptoms (pt. reported) that required medical intervention within the past 6 months
- 2) Any other musculoskeletal, neuromuscular, or cardiopulmonary dysfunctions unrelated to MS
- 3) Hearing problems requiring an assistive device
- 4) MMSE score of < 24

Case Descriptions

Examination/Evaluation:

- Initial/baseline and post-treatment
- History/Subjective:
 - General history of disease course
 - Date of last exacerbation
 - Location/type of pain/symptoms
 - Comorbidities
 - Medications

Case Descriptions

► Objective:

- ROM (C/S, UE, LE, L/S)
- Manual muscle testing (UE, LE, trunk, grip strength)
- Modified Ashworth Scale
- Proprioception

► Instrumentation: **Focus on functional balance**

- MMSE
- Snellen- visual acuity
- Dallas Pain Questionnaire
- Multiple Sclerosis Quality of Life Index (MSQLI)
- **Balance Master- series of 11 tests**
- **Berg Balance**
- **Dynamic Gait Index**

Tools	Reliability	Validity	Population	Reference
MMSE	Yes (intra & interrater)	Yes (concurrent)	Adults	Folstein (1975)
Modified Ashworth	Yes (interrater)	Yes (face validity)	Adults with CNS lesions	Bohannon & Smith (1987)
Balance Master	Yes	Limited validity in MS population	Multiple Sclerosis	Anyan et al (2004)
Berg	Yes	Yes	Elderly	Berg (1989)
Dynamic Gait Index	Yes (inter and intrarater)	Yes (concurrent)	Multiple Sclerosis	McConvey (2003)
MSQLI	Yes (internal consistency)	Yes (content and construct)	Multiple Sclerosis	Fisher et al (1999)
Dallas Pain Questionnaire	Yes (internal consistency)	Yes (concurrent)	Chronic spinal pain	Lawlis et al (1984)
Movement Imagery Questionnaire	Yes (internal consistency & test-retest)	Good predictive validity	Adults	Hall & Ponagrac (1983)

Patient A Baseline

► Berg Balance

- 42/56
- Used hands for transfers; could not alternately toe tap; turning 360°

► Dynamic Gait Index

- 14.5/24
- Generalized mild/moderate impairments

► Balance Master

- Unable to sit-stand; no directional control with weight shift; used cane for step up/over

Patient B Baseline

► Berg Balance

- 53.5/56
- Difficulty with standing unsupported with feet together; standing with eyes closed

► Dynamic Gait Index

- 20/24
- Demonstrated mild impairments

► Balance Master

- Increased sway velocity unilateral stance with EO/EC; Decreased directional control/on-axis velocity with RWS at faster speeds

Intervention

- ▶ Individually designed *task oriented* MP programs via audio tape recording with *randomized schedule practice*
- ▶ Patient education
- ▶ Participated 5 days/week for 4 weeks
- ▶ Patients kept a log of the sessions and reported subjective findings
- ▶ Patients were contacted periodically to encourage compliance

Patient A Intervention

- ▶ **1st tape:**
 - Approximately 5 minutes relaxation exercises & 8 minutes of MP exercise
 - Single leg stance
 - Stepping up and over a step
 - Sit to stand/stand to sit transitions
 - Alternate toe tapping
- ▶ **2nd tape** (given after 2 wks of MP):
 - Approximately 5 minutes of relaxation exercises & 8 minutes of MP exercise
 - Sit to stand/stand to sit transitions
 - Single leg stance
 - Ascending a flight of stairs

Patient B Intervention

- ▶ **1st tape:**
 - Approximately 5 minutes relaxation exercises & 7 minutes of MP exercise
 - Single leg stance
 - Stepping up and over a step
 - Walking with head turns
- ▶ **2nd tape** (given after 2 wks of MP):
 - Approximately 5 minutes of relaxation exercises & 7 minutes of MP exercise
 - Ascending/descending stairs
 - Walking and picking up objects from the floor and a table
 - Kicking a ball

Patient A Post-test

Baseline

- ▶ **Berg Balance**
 - 42/56
 - Used hands for transfers; could not alternately toe tap; turning 360°
- ▶ **Dynamic Gait Index**
 - 14.5/24
 - Generalized mild/moderate impairments
- ▶ **Balance Master**
 - Unable to sit-stand; directional control with weight shift; used cane for step up/over

Post-Test

- ▶ **Berg Balance**
 - 52/56
 - Able to sit-stand without use of hands
 - ▶ 2 inch seat height difference
 - Alternately tapped feet >2 steps
- ▶ **Dynamic Gait**
 - 18/24
 - Mainly mild impairments
- ▶ **Balance Master**
 - Unable to sit-stand but did initiate
 - Improved front/back on-axis velocity and directional control

Patient B Post-test

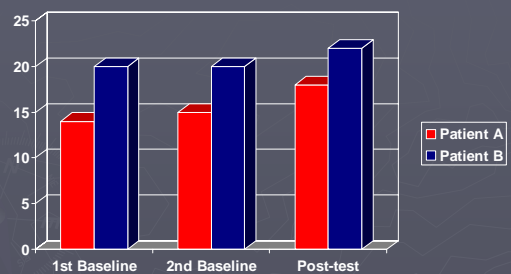
Baseline

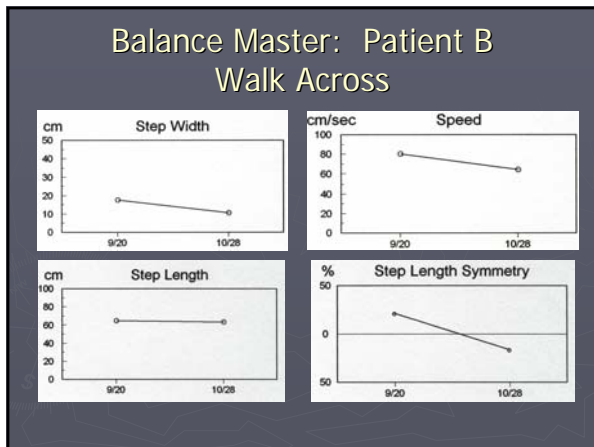
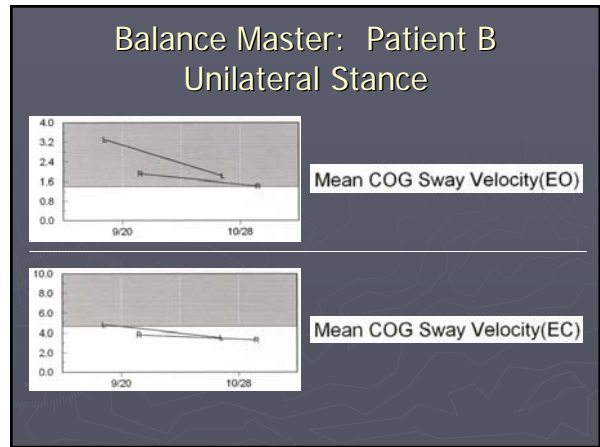
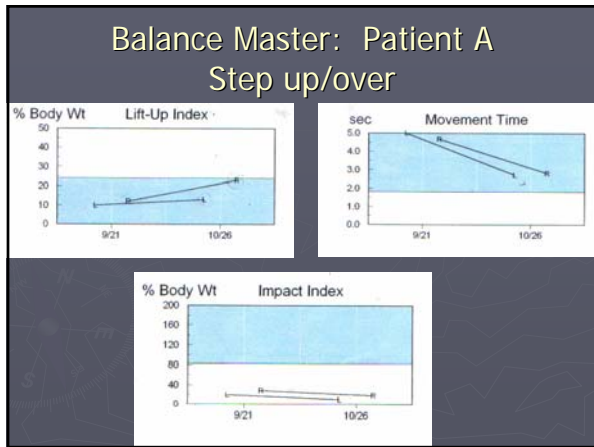
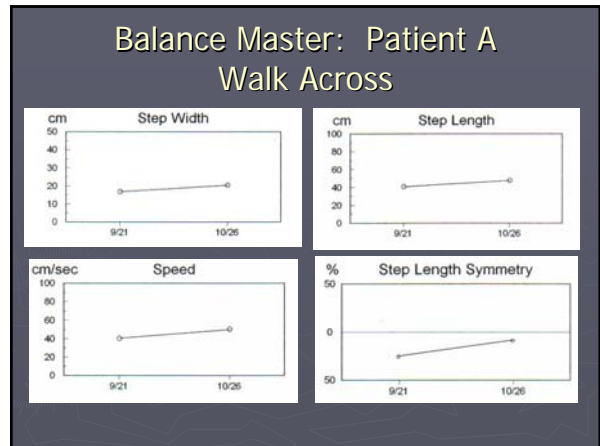
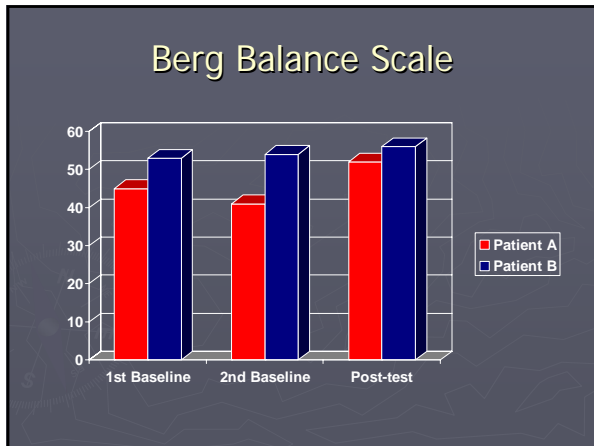
- ▶ **Berg Balance**
 - 53.5/56
 - Standing unsupported with feet together; standing with eyes closed
- ▶ **Dynamic Gait Index**
 - 20/24
 - Demonstrated mild impairments
- ▶ **Balance Master**
 - Increased sway velocity unilateral stance with EO/EC; limited directional control with rhythmic weight shift

Post-test

- ▶ **Berg Balance**
 - 56/56
 - Able to stand safely 10 sec with eyes closed
 - Able to stand safely with feet together 1 min with no assist
- ▶ **Dynamic Gait**
 - 22/24
 - Mild impairments
- ▶ **Balance Master**
 - Decreased sway velocity unilateral stance with EO/EC; improved directional control with rhythmic weight shift; decreased step width

Dynamic Gait Index





- ### Discussion
- ▶ Ceiling effect for Patient B
 - ▶ Tools not sensitive to detect change in some patients
 - ▶ Tools not validated for MS specifically
 - ▶ Audio Tapes vs MP in the clinic
 - ▶ Psychological
 - MSQLI

Future Research

- ▶ More participants
 - Variability of patients with MS
- ▶ Increase compliance by participant coming to the facility
- ▶ More time for intervention
- ▶ Combined MP and Physical Therapy
- ▶ Warrants further investigation

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