The Impact of Mental Practice on Performance of Daily Tasks in Clients Post Stroke

Patricia Wagner
Pacific University

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The Impact of Mental Practice on Performance of Daily Tasks in Clients Post Stroke

Prepared by: Patricia Wagner, OTS  (wagn0476@pacificu.edu)

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CLINICAL SCENARIO:

Roughly 795,000 Americans experience a new or recurrent stroke each year (American Heart Association, 2011). Individuals who withstand a stroke often encounter motor impairments that may impact their ability to perform various significant and purposeful activities on a daily basis. Hemiparesis is a typical neurological impairment that is displayed after a stroke and can range from weakness to complete paralysis of the affected side (Woodson, 2008). A number of interventions have been explored in the rehabilitation setting to remediate and restore functional performance in the affected limb in stroke recovery. For instance, mirror therapy in addition to a standard rehabilitation program (Yavuzer et al. 2008) and constrained-induced movement therapy (Taub, Crago, & Uswatte,1998) have been utilized, demonstrating improvements in hand and arm function for clients with subacute and chronic stroke. Mental practice has also been a therapy explored in recent studies, finding similar effects (Page, 2000; Muller, Butfisch, Rudiger, & Homberg, 2007).

Mental practice is a training method that uses a number of cognitive processes, including motor imagery, that consists of repeating imagined motor acts several times to improve performance. This may be used to learn a new skill or ability or perfect one that is familiar (Jackson, Lafleur, Malouin, Richards, & Doyon, 2001). With this in mind, this CAT has been conducted to investigate the impact that mental practice training has on performance of daily tasks in clients post-stroke, rather than focusing solely on improvements of residual impairments.

FOCUSED CLINICAL QUESTION:

What impact does mental practice training have on performance of daily tasks in clients post stroke?

SUMMARY of Search, ‘Best’ Evidence’ appraised, and Key Findings:

- Five research articles were included in this CAT, investigating the impact of mental practice training on functional recovery in clients post-stroke.
- A systematic review by Braun, Beurskens, Borm, Schack, & Wade (2006) was deemed as providing the best evidence, which explored the impact of mental practice (MP) intervention on recovery in clients that have had a
stroke. The investigators found that for clients that have either acute or chronic hemiplegia, mental practice intervention seems to provide improvements in upper and lower extremity impairment and function.

- Liu, Chan, Lee, & Hui-Chan (2004) studied the effectiveness of a mental imagery (MI) intervention in relearning daily tasks after an acute stroke. The study found that participants in the MI program demonstrated significantly greater improvement in performance on trained tasks after weeks 2, 3 and at the 1-month follow up; and on untrained tasks at the end of the program.

- Page, Levine, & Leonard (2005) studied the effects of MP on use and function of the affected limb in clients that have had a stroke and are in the chronic phase. Participants in the MP group reported greater affected limb use and quality of movement and demonstrated significantly higher changes in upper limb function than those in the control group.

- Page, Levine, & Leonard (2007) investigated the impact of a MP regime on upper extremity motor function in clients with chronic stroke. Participants with MP in their program displayed significantly greater improvements than those in the program with relaxation.

- Page, Dunning., Hermann, Leonard, & Levine (2011) studied the effects of varying lengths of MP sessions on the movement of the affected upper extremity for clients post-stroke. Greater reductions in impairment were seen in participants with MP than those without and with increasing duration of MP, with 60 minutes demonstrating the largest change.

**CLINICAL BOTTOM LINE:**

Mental practice (MP) appears to provide positive effects in functional recovery for clients post-stroke with hemiparesis when used along with physical practice in rehabilitation. A specific intervention protocol cannot be justified as more effective than others due to the inconsistent MP strategies used among the studies found. Future research is needed to identify if improvements in affected limb functioning on performance of tasks can be retained and implemented in occupations of daily living.

**Limitation of this CAT:** This critically appraised topic has been prepared by a master’s of occupational therapy student and peer-reviewed by other occupational therapy students and a faculty member.
SEARCH STRATEGY:

Terms used to guide Search Strategy:

- **Patient/Client Group:** Clients post-stroke
- **Intervention (or Assessment):** Mental Practice, Motor Imagery, or Mental Imagery
- **Comparison:** None
- **Outcome(s):** Functional improvement in performance of daily tasks

<table>
<thead>
<tr>
<th>Databases and sites searched</th>
<th>Search Terms</th>
<th>Results</th>
<th>Limits used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ovid MEDLINE 09/2011</td>
<td>“Mental Imagery” OR “Mental Practice” OR “Motor Imagery” OR AND “Stroke”</td>
<td>107 27 relevant</td>
<td>English</td>
</tr>
<tr>
<td>CINAHL 9/2011</td>
<td>“Mental Imagery” “Mental Practice” “Motor Imagery” AND “Stroke”</td>
<td>185 35 relevant</td>
<td>None</td>
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<tr>
<td>Google Scholar 10/2011</td>
<td>“Motor Imagery and Stroke Rehabilitation”</td>
<td>46 4 relevant</td>
<td>Since 2001</td>
</tr>
</tbody>
</table>

INCLUSION and EXCLUSION CRITERIA

- **Inclusion:**
  - Study participants who have experienced a stroke and resulting hemiparesis
  - Outcomes related to functional improvement in task performance
  - Studies published within the last 10 years
  - Studies that used mental practice as an intervention

- **Exclusion:**
  - Studies not in English
  - Participants without stroke
  - Studies published prior to 2001
  - Outcomes not related to functional improvement
RESULTS OF SEARCH

Five relevant studies were located and categorised as shown in Table 1 (based on Levels of Evidence, Centre for Evidence Based Medicine, 1998)

Table 1: Summary of Study Designs of Articles retrieved

<table>
<thead>
<tr>
<th>Study Design/ Methodology of Articles Retrieved</th>
<th>Level</th>
<th>Number Located</th>
<th>Author (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic Review</td>
<td>I</td>
<td>1</td>
<td>Braun et al. (2006)</td>
</tr>
<tr>
<td>Randomized Control Trial</td>
<td>I</td>
<td>4</td>
<td>Liu et al. (2004)</td>
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<td>Page et al. (2011)</td>
</tr>
</tbody>
</table>

BEST EVIDENCE

The following study/paper was identified as the ‘best’ evidence and selected for critical appraisal. Reasons for selecting this study were:

- The systematic review selected provides the highest level of evidence for answering the clinical question.
- Three of the four randomized controlled trials (RCTs), controlled clinical trial (CCT), patient series, and single case reports were published within the last 10 years.
- Intervention outcomes focused not only on impairment changes but on functional improvements that would reduce limitations on activity performance.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of Systematic Review (The effects of mental practice in stroke rehabilitation: a systematic review) by Braun et al. (2006).

Study Design: Systematic Review

Objective of the Systematic Review:

The aim of this systematic review was to evaluate the impact of mental practice intervention on recovery in clients that have had a stroke.

Searching Strategy:

A computer-based search was utilized to explore the following databases: Cochrane Database of Systematic Review, PubMed/Medline, PsycINFO, Pedro, Rehadat, and
Rehab Trials. The main strategy employed was that developed for searching PubMed and Cochrane, which was altered for other searches as needed. The key terms implemented in the search were: imagery, rehabilitation, physical therapy, activities of daily living, psychomotor performance, and stroke (Braun et al., 2006). During this time, authors and further studies were sought out from the reference lists provided within the articles of interest to expand the search. Three investigators independently explored the data sources.

**Selection Criteria:**

The inclusion criteria of the systematic review included the following:

**Population:** The population included in this systematic review were clients who have experienced a stroke. Exclusions included participants not primarily diagnosed with a stroke or who presented severe pathology in addition to a stroke.

**Interventions:** The types of tasks and intervention could be done outside of physical therapy, secured within rehabilitation therapy, and be the only therapy intervention delivered. Interventions incorporating electromyographic simulation and feedback as well as computer-based simulations of virtual reality were excluded (Braun et al., 2006). Use of medication was also excluded in this review.

**Outcomes:** According to Braun et al (2006), attention was given to interventions that supported functional improvements that would reduce limitations on activity performance rather than on impairment changes alone. If primary focus was placed on increasing psychological, visual, speech, sleep, or behavior performance, the study was excluded.

The study selection included level I randomized control trials (RCTs) and controlled clinical trials (CCTs), level II cohort studies, and level III single cases and non-controlled client series that were in English, German, French and Dutch through August 2005. RCTs and CCTs were emphasized more so than those within lower levels. Overall, the articles chosen included: 4 RCTs, 1 CCT, 2 patient series, and 3 single case studies that reported the effects of mental practice in physical recovery during adult stroke rehabilitation.

**Intervention Investigated**

The investigated intervention was that of mental practice, which is when “an internal representation of the movement is activated and the execution of the movement repeatedly mentally simulated, without physical activity, within a chosen context. It is used for the goal-oriented improvement or stabilization of a given movement” (Braun et al., 2006, p. 843). The main mental practice strategies used within the studies explored included tape instruction, self-regulation, and practice after observation. In a number of the studies, tasks were worked on with physical and mental practice. Within the level I studies, tasks ranged from reaching for a cup, turning a page, and performing effective use of a pencil to those used in household, cooking, and shopping activities.

Within the level I studies analysed, the length of the intervention periods were found to be between 3 to 6 weeks and were at least given 2 times per week for 30 minutes
using guided mental practice. Unguided mental practice was given a number of sessions per day to a total of 3 times a week (Braun et al., 2006).

**Outcome Measures**

Four class 1 and 3 level III studies examined the effects of the mental practice intervention on arm function, while 2 of the level III studies examined the impact on the leg and foot. Another level I study explored the impact on arm function and also implemented training of other skills.

The Fugl-Meyer Assessment of Motor Recovery after Stroke (FM) and Action Research Arm Test (ARAT) were the two most commonly used outcome measurement instruments in the RCTs that assessed physical functioning of the affected limb. Other outcomes of interest in the RCTs included: performance of tasks, attention control, improved competence, and quality and frequency of use. The CCT looked at physical functioning, somatosensory functions, perceived personal recovery and attention control, and emotional distress.

**Main Findings:**

The client characteristics, intervention protocols, mental practice strategies, and outcome measures varied within the studies reviewed. Four different mental practice strategies were used; however, due to the variations in interventions, one protocol over the others could not be deemed more beneficial when comparing those that included mental practice and physical activity. Among the mental practice approaches used, tape instruction and self-regulation seemed to be the most beneficial (Braun, 2006).

From the evaluation of the results of the individual studies, it was found that three of the level I studies that demonstrated sufficient methodological quality presented positive results for participants after engaging in a mental practice intervention, which included enhancement of performance in arm function alone and when involved with other skills. Other studies implemented in this review also found positive effects when mental practice was incorporated as an additional therapy. Such effects included improvement in recovery at the impairment and activity level of arm and leg functions.

**Original Authors’ Conclusions**

According to the authors, a strong conclusion could not be extracted from the studies reviewed concerning the effects of mental practice in stroke rehabilitation. However, further research must be implemented in the future that clearly defines the mental practice technique utilized and employs standardized outcome measures.
Critical Appraisal:

Validity

Clinical Question:
• The clinical question that the review is trying to answer is clear and focused on adult stroke patients, mental practice interventions, and outcomes of recovery, which include reduction of limitations in activities and change in impairment in the affected limb.

Literature Search:
• The literature search method was clearly specified in the review, but may be subject to limitations in the procedures used to search and categorize studies in the noted databases, leading to a slight possibility that studies were overlooked. Furthermore, personal communications with researchers or experts on the subject were not included to identify articles that have not been published or to obtain data not included in the original publications.

Selection of Studies:
• The criteria used for the selection of studies were focused on the effects of mental practice interventions during rehabilitation in physical recovery of adult clients who have had a stroke. The research designs emphasized were level I RCTs and CCTs. RCTs provide the most reliable results when exploring the effectiveness of an intervention, such as mental practice. Other level III studies were included to provide a more thorough outline of the present evidence answering the clinical question.

Methodological Quality:
• The identified studies were evaluated for methodological quality using the 12 internal validity item Amsterdam-Maastricht Consensus List for Quality Assessment (AMCL).
• Three of the five level I studies, CCT and RCTs, were defined as having sufficient quality.
• Two reviewers independently assessed the methodological quality and described the study characteristics of the RCTs and CCT included in the review. Validity criteria were discussed and defined beforehand to prevent differences in the assessment process when determining the quality of the studies.
• The investigators did not contact the researchers of the studies reviewed to obtain missing values or information. With this in mind, the research done in the studies may not have been fully examined as the information and data found was limited to what was presented in the articles. This may have distorted the results of the review.
• The researchers were familiar with the written work in this area of study; therefore, the articles were not blinded.

As can be seen, the systematic review of the effects of mental practice in stroke rehabilitation meets a number of the criteria for internal validity. However, the review is limited to the information found within the articles obtained, which may distort the results and the true effect of the intervention that is being explored.
Interpretation of Results

This systematic review has demonstrated that studies focusing on this clinical question differ in regards to the population characteristics, dose and period of interventions administered, in the type of mental practice approach used, and outcome measures employed. Due to the variability between the studies, statistical methods could not be effectively used to analyse or summarise the results of the studies included in the review.

Furthermore, the majority of the studies reviewed did not report blinding of the clients or therapists, had little power due to small sample sizes, and did not provide a follow-up to determine the long-term effects of the intervention.

On the other hand, when placing primary focus on the results of the individual studies, the review provides evidence that clients with hemiplegia after a stroke may potentially see gains in physical activity and reductions in impairment of the affected limb after applying mental practice in combination with movement as an additional therapy to PT or OT services. From these findings, it is evident that mental practice interventions provide more benefit than potential harm to clients post-stroke, as adverse side-effects or potential risks were not detected or noted in previous studies.

Summary/Conclusion:

Overall, the systematic review provides evidence that mental practice in combination with physical practice may be beneficial for clients experiencing functional impairments of the affected limb after a stroke when it is administered in addition to physical or occupational therapy services. The information and data obtained from the studies in this review were limited to what was found in the articles published, which may have altered the true results of the interventions administered within the actual studies themselves. The lack of consistency between the studies and noted limitations make it difficult to generalize the effects of mental practice intervention in clients post-stroke. The degree to which the participants retained and utilized the benefits of mental practice also remains unclear.

Nonetheless, further research is necessary to determine the client characteristics, dosage, intervention protocols, and mental practice strategies that display the greatest improvements in functional recovery of the involved limb. Larger studies with stronger methodological quality are also needed to provide sound evidence in the effectiveness of mental practice in recovery on performance of daily tasks for those who have experienced a stroke and have residual motor impairment. These results are also supported by the systematic reviews conducted by Zimmermann-Schlatter, Schuster, Puhan, Siekierka, and Steurer (2008) and Nilsen, Gillen, and Grodon (2010).
### Table 3 Characteristics of included studies

|-------------------------------|----------------------------|---------------------------------|----------------------------|
| **Sample** | N=46  
>60 y/o; 72.7  
Acute Phase Hemiparesis | N=11  
53 to 71 y/o; 62.3  
Chronic Phase  
>1 year post stroke  
Hemiparesis and nonuse (10 on dominant side) | N=29  
21 to 76 y/o; 60.8  
Chronic Phase  
>1 year post stroke  
Hemiparesis (15 affecting right arms) |
| **Intervention investigated** | Intervention: 3 weeks with five 1 hour sessions per week working on a total of 15 trained functional tasks  
Extra 1 hour PT session 5 days a week  
**Mental Imagery (MI) program (N=26)**  
MI was paired with performance of tasks for total of 3 weeks:  
**Week 1:** Analysing task sequences to enable motor planning and identification of problems  
**Week 2:** Problem identification through MI  
**Week 3:** Rehearsal of corrected task performance using MI and practice | Intervention: Participants received 30 minute therapy sessions for the affected upper extremity 2 times a week for 6 weeks  
**Mental Practice (MP) and Physical Practice:** Physical practice with additional MP was provided that included a 30 minute audiotape recording with 5 minutes of progressive relaxation, 20 minutes of mental rehearsal of ADLs practiced, and the final 3-5 minutes set aside to redirect attention back to the setting. | Intervention: 2 days per week with 30 minute therapy sessions for 6 weeks. Same physical practice routine was used for both groups.  
**Mental Practice (MP) and Physical Practice:** The experimental group also received a 30 minute recorded MP intervention with 5 minutes of progressive relaxation, 20 minutes of mental rehearsal of motor skills practiced and 5 minutes to refocus. |
| **Comparison intervention** | **Functional Retraining (FR) Program (N=20)** | **Progressive Relaxation and Physical** | **Relaxation and Physical Practice** | **Sham/Control:**  
20 minute recordings of |
- Demonstration-then-practice method  
- Same tasks practiced as MI group with similar sequence and training schedule  
- Adapted task performance

| Practice: Following the same physical practice as the MP group, the control group listened to a 30 minute recording of a progressive relaxation program.  
| The control group was given a sham intervention after the therapy session or physical practice, which included a 30 minute recorded progressive relaxation program.  

### Outcomes used

| Motor Activity Log (MAL): Use and quality of movement of the affected limbs during ADLs.  
| Action Research Arm Test (ARAT): Upper limb function (primarily fine motor)  
| Action Research Arm Test (ARAT): Upper limb function (grasp, grip, pinch, gross movement) to measure activity limitation.  

#### Frequency:

- **Pre-testing:** Two separate times, 1 week apart  
- **Post-testing:** At the end of the 6 week testing period  
- **Follow-up:** None

- **Pre-testing:** Two times 2 weeks apart  
- **Post-testing:** One week after therapy  
- **Follow-up:** None

### Findings

| Participants in the MI program demonstrated significantly greater improvement in performance on trained tasks after weeks 2, 3 and at  
| Participants and their caregivers reported greater affected limb use and quality of movement than those within the control group. Those within the program with MP in their program displayed significantly greater improvements than those in the program with MI.  

| Participants with MI in their program displayed significantly greater improvements than those in the program with relaxation exercises, information on stroke, stroke prevention, and exercises for the affected lower extremity were given following the allotted time for practicing the specified tasks.  
| Fugl-Meyer Scale (FM): Upper extremity section to assess changes in motor impairment  
| Action Research Arm Test (ARAT): Upper limb function  

#### Frequency:

- **Pre-testing:** Administered 2 different times 1 week apart  
- **Post-testing:** At the end of the 10 week testing period  
- **Follow-up:** None

Participants with MP in their program displayed significantly greater improvements than those in the program with relaxation exercises, information on stroke, stroke prevention, and exercises for the affected lower extremity were given following the allotted time for practicing the specified tasks.
the 1-month follow up; and on untrained tasks at the end of the program. MP group also demonstrated significantly higher changes in upper limb function as noted from ARAT scores. relaxation. Those with MP and physical practice showed reductions in impairment and increases in movement of the affected arm. demonstrating the largest change. Participants with MP presented larger motor changes than those without.

**IMPLICATIONS FOR PRACTICE, EDUCATION, AND FUTURE RESEARCH**

The studies included within this CAT provide promising evidence that mental practice intervention paired particularly with physical practice during post-stroke rehabilitation can potentially improve functional performance and reduce impairment of the affected limb, notably the upper extremity. Mental practice is a risk-free strategy that is cost-effective and has potential to benefit clients that experience hemiparesis after stroke. The studies do not, however, provide a conclusive mental practice intervention strategy or strong evidence as to who can participate in the training within the population of interest and to what degree they may benefit. With this in mind, definite conclusions cannot be made concerning the impact that mental practice training has on performance of tasks in clients post-stroke.

In addition, training of particular mental practice strategies must be implemented as continuing education for local therapists or for students in order to ensure the highest degree of effectiveness when working with clients in stroke rehabilitation. It is also important to educate the client and family members on the effectiveness of mental practice and the potential benefits. The client must be taught the strategies in order to actively participate during the therapy and when applying it at home if appropriate.

Furthermore, as has been noted, further research is needed in this area of study. Larger studies with stronger methodological quality are needed to provide sound evidence in the effectiveness of mental practice on recovery for those who have experienced a stroke. Client characteristics, dosage, intervention protocols, and mental practice strategies need to be further researched in order to determine those that reveal the greatest improvements in functional recovery of the involved limb. The effectiveness of mental practice in clients with right versus left hemisphere stroke should also be studied in the future and determine the impact that the training has on those whose dominant side is affected. Follow-up sessions with participants must be employed to determine whether the clients maintain the improvements made and are able to participate in desired occupations. Using qualitative research, it would also be advantageous to explore the participant’s and caregiver’s perceived improvements in performance of daily tasks after mental practice intervention through qualitative research.
REFERENCES


