Effect of Mental Practice on Static and Dynamic Balance in the Community-Dwelling Elderly

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Abstract

This experimental field study examined the potential usefulness of mental practice for improving physical performance in health care. This main purpose of this study was to investigate the effects of an 8-week trial of mental practice of motor imagery on static and dynamic balance in community-dwelling elderly. 80 elderly females were recruited from a gymnasium and randomly assigned 2 groups. The experimental group received 20 minutes of mental practice of motor imagery. The study lasted for 4 month, 32 intervention sessions, with each intervention session lasting for 45 minutes. Pretest-Posttest outcome measures included the timed up and down stair. Independent t-test for both dynamic and static balance were significant (respectively: p= 0.001, p=0.01). Our study concludes that mental practice may hence be an important therapeutic tool to improve both static and dynamic balance in elderly.

Keywords: Balance, Elderly, Mental practice, Physical exercise, Mental imagery.

Introduction

Observing principles of health and immunity has led to the increase in average lifespan, so 17% of the world's population in 2006 was aged people. It is predicted that this figure would increase to 25% in 2030 (SCB 2006). Aged people deserved physical, psychological and social health, so prevention and overcoming on aged people's disabilities, and examining the effective factors on improving life quality are of utmost important. The most common problem in older adults is reduced balance and lack of postural control that lead to increase the chance of falling and instability during walking. Since balance maintenance is considered one of the indices determining aged people's independence, so examining and identifying the effective factors on balance changes is examinable topic that researchers are interested in (Gribble et al., 2004).

Mental practice (MP) has been shown to be an effective in enhancing motor performance, specifically in sports, dance and music (Fell & Wrisberg, 2001). MP is defined as the cognitive rehearsal of a physical skill in the absence of overt physical movements. Research also supports the use of MP to acquire new motor skills or to relearn motor patterns that have been disrupted by trauma or disease (Batson, 2004; Page et al., 2001). Mental practice involves two types of imagery: Kinesthetic imagery, in which individuals imagine the sensation of physical performance, and visual imagery in which individuals vividly see themselves performing a motor skill (Hall & Martin, 1997). There are two main theories within sport psychology that explain the relationship between imagery and physical performance: 1. Psycho neuromuscular theory and 2. Symbolic learning theory. The psycho neuromuscular theory suggests that imagery duplicates the rehearsed motor skill itself, even though the neuromotor activation is of a much, much smaller magnitude compared to the performance of the physical act itself.

This is often referred to as muscle memory (Van Raalte & Brewer, 2003). In more simple terms, this suggests that when a person uses mental imagery, the muscles used in the rehearsed action are stimulated at a very low level. This allows for the muscles to learn the technique, improving performance when the task is at hand. Clinical advantages to administering MP include: low cost, group delivery, no additional equipment needed, and easy incorporation into home programs. MP potentially is easy to customize for teaching and learning, and to combine with other techniques for general stress reduction, and enables additional practice of motor skill-programming without fatiguing for the user (Van Leeuven & Inglis, 1998). Some studies has reported that mental practice resulted in promoting motor recovery in patients with neurologic disorders (Jackson et al., 2003), an increase in gait speed and knee range of motion in a case study of an individual post-stroke (Dickstein et al., 2004). Since physical practice improves balance, it is assumed also that the application of mental practice would be useful in enhancing such balance. Thus, the purpose of this study was to investigate the effect of mental practice on balance in the community-dwelling elderly.
Methodology

This is a randomized controlled study. 80 independently ambulatory subjects (age group 50-70yrs) were randomly selected and divided into 2 intervention and control groups of 40 each. Eligibility criteria included: the absence of neurological or orthopedic diagnoses that would necessitate moderate-to-maximal assistance, increased risk of potential harm from physical activity, visual, auditory, or speech deficits that would interfere with understanding instructions and/or execution of the task, not participating in any regular fitness or exercise program. The experimental group received 20 minutes of mental practice of motor imagery. Mental practice involved use of idealized visual and kinesthetic mental images provided to subjects through recorded tape.

The study lasted for 4 month, 32 intervention sessions, with each intervention session lasting for 45 minutes. Pretest-Posttest outcome measures included the timed up and down stair test (dynamic balance) and stork test (static balance). Pretest-posttest conditions for all outcome measures were standardized as much as possible in terms of location, equipment, and instructions. Subjects were given the instructions on how to perform each test and asked if the directions were understood.

Mental practice protocol

The MP group was guided through a series of mental practice of motor tasks pre-recorded on an audiotape, which included body scanning and functional movements. The group was asked to mentally follow the cues on the tape for specific tasks, without performing any physical movement. Statements instructed the subjects to see yourself doing or feel yourself moving. Independent t-test was used to analyze the static and dynamic balance. Data was considered significant at the .05 level.

Results

Results are reported in tables 1 through figures 1 and 2. Independent t-test for both dynamic and static balance were significant (respectively: p=0.001, p=0.01).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention</th>
<th>Control</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static balance</td>
<td>14.7±1.2</td>
<td>10.09±1.7</td>
<td>0.01</td>
</tr>
<tr>
<td>Dynamic balance</td>
<td>11.13±1.4</td>
<td>15.2±1.5</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 1. Comparing the research variables between intervention and control groups.

* Significant at P≤0.05

Figure 1. Comparing of dynamic balance in intervention and control groups.
The purpose of this study was to examine the effect of mental practice on static and dynamic balance in the community-dwelling elderly. Pretest-posttest comparisons of scores for both static and dynamic balance showed statistically significant for the intervention group (Table 1, Figure 1 and 2). Although fall risk was not measured in this study, increases in movement efficiency as measured by static and dynamic tests, imply increased balance and functional mobility, but results cannot be attributed to the addition of MP in the protocol. In this study, the effect of MP of motor tasks on balance is inconclusive. The sample size, length of the study, and other methodological factors (discussed below) in this study indicate that more research is warranted.

Several reviews of the literature on MP of motor imagery support the use of MP as an adjunct to PP in increasing performance (Driskell et al., 1994). Although physical practice is considered superior to MP in learning and improving motor skills (MP can augment physical practice to improve motor skills, and is better than not engaging in any activity at all (Hall et al., 1992). MP is reported to enhance motor skill acquisition of novel tasks at a faster rate than physical practice alone. The more a person practices a motor task (either mentally- or physically), the more readily it is learned (Schmidt & Lee, 1991). Personal factors also may have affected variability of performance and were hard to control. Mood, personal distractions, sickness, level of hunger or fatigue, and/or response to weather potentially could affect ability to mentally focus, motivation, and performance in MP.

In addition, given the natural effects of aging, the study may have been too brief a time to assess the effects of MP or to allow for clinically significant changes in physical performance. The group may have benefited from a longer intervention with a home exercise program for reinforcement. Finally, there are aspects of MP that were not explored in this study, such as motivation. The motivation hypothesis postulates that MP increases the subject’s motivation to improve (Wichmann & Lizotte, 1983). According to the vicarious conditioning paradigm, mental practice is equivalent to watching a model perform the task and, therefore results in learning (Richardson, 1964). Other benefits include more focused attention and enhanced concentration, greater awareness of self and improved performance (Murphy, 1990; Onestack, 1991). Evidence from electromyographic and neuroimaging studies suggest that the brain uses the same regions in MP as it does in actual physical practice (PP) (Decety, 1996; Porro, 1999). Therefore, mental practice may be used as an effective tool for older adults to gain more balance.

References

Decety J, 1996. Do imagined and executed actions share the same neural substrate?. Cognition and Brain Research. 3: 87-93.