IMPACT OF SIX WEEKS SELECTED BALANCE EXERCISES ON IMPROVING MULTIPLE SCLEROSIS PATIENT’S BALANCE

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Abstract
Background: Multiple Sclerosis (MS) is the most prevalent disabling neurotic disease in young adults. It cause demyelination of nerve axons, which can lead to lack of normal actions that through them central nervous system (CNS) attempts to communicate with the body and vice versa. One of common symptoms of MS is loss of balance and decreased walking ability. The purpose of this study is the effect of 6-week Balance Training on People with Multiple Sclerosis. Methods: 20 subject with mild to moderate disability, by Kurtzke scale (Expanded Disability Statues Scale), was randomized into experimental group (n=10) and control group (n=10) after they were assessed with Berg balance Scale. Then timed up & go test and Timed Walk test used to assess their physical mobility and gait speed. These tests were repeated each two week for groups. After 6 weeks all data collected and analyzed with repeated measure and t-test. Results: Results showed statistically significant differences among groups. Experimental group showed a significant improvement in balance, mobility and gait speed, but there were no significance differences in control group. Conclusion: The result of this study revealed that balance exercise can improve balance in people with multiple sclerosis.

Key words: multiple sclerosis, balance training, balance, mobility, gait speed

Introduction
The positive effects of exercise in the prevention and control of disease has been reported in various studies. Regarding the effect of exercise on physical and mental health and the importance role of it in the treatment of diseases along with other therapies, there has been an increased attention to the physical science medical aspects, its scientific aspects and sports and exercise. Physical exercise as complementary treatment in the field of modern medicine has been accepted by the scientific community (Schopen et al., 1999). In recent years multiple sclerosis is one of the diseases that have attracted the attention of researchers (a disease of the central nervous system) in which myelin sheath is destroyed and caused many problems in these patients. The task of myelin sheath is to protect nerve cell electrical impulses that travel around the body normally at a speed of 225 miles per hour (Abramovitz, 1982). When myelin sheath is damaged or destroyed, tissue remains damaged and the transmission of nerve impulses speeds reduces to 110 miles per hour. So the speed of nerve impulses in the brain and throughout the body is reduced by half and causes the nerve to be unclear or confusing or overlooked by other nerve cells (Abramovitz, 1982). Among the problems faced by these patients is imbalance that results in inactivity. Besides the basic problems and the effects of the disease on body, symptoms and secondary problems is to include psychological, psychological, and social effects of the initial problems raised in the MS (Abramovitz, 1982).

However, today many reliable methods available for the diagnosis of MS, but no one knows what is the primary cause of the disease (Wilson et al., 1991). Imbalance increases the risk of falling and fear of falling in people who have balance problems (Cleaven, 2004). One of the most common symptoms of multiple sclerosis is disability associated with gait and balance due to reduced balance with the increasing muscle weakness and fatigue (Abramovitz, 1982). From past to present, many researchers turn their attention to the impact of exercise on improving balance and physical activity for MS patients, using strength, endurance and stretch training. Among these researchers are Cattaneo et al., (2007), Jackson et al (2002), Debolt and MacQueen (2004), Kasser et al., (1991), Konrosdottir et al., (2007), Wiles et al (2001), Petajan and White (1999). Despite such researches, but yet the role of exercise, especially to improve balance on the disease is a mystery, in this regard, the present study was to assess the role of balance exercises alone.

Study Method
In this quasi-experimental study, 20 MS patients with mild to moderate disabilities using disability status Kurtz scale (2 to 5/5) at a mean age of 37/1 ± 2/2 were selected in Multiple Sclerosis Association of Shiraz. All participants in the study signed a consent form and were taking their medicine in the study six weeks. Before exercises started, samples were randomized into experimental group and control group after assessed with Berg Balance Scale.
Berg Balance Test is a tool for quantitative assessment of the balance with 14 steps; each step is rated from four to zero and has a total of 56 points. It tests both static and dynamic balance. Scores obtained by the subjects in each test case, are summed up to determine the balance amount (Kurtzke, 1983; Shumway-Cook et al., 1997). Berg Balance Scale test and three others scales validity (used to assess balance and mobility in MS patients) has been reported by a survey conducted by Cattaneo et al., (2007) to be between 0.85 to 0.96. After cloning, both a physical mobility and speed test were performed. Also “Timed up & go” test and “Timed Walk” test used to assess physical mobility and gait speed. These tests were repeated each two weeks for groups and data was recorded. In the evaluation of the physical mobility two chairs (an armchair and a chair without arm) to a distance of 3 m from each other were used. Subjects sat on a chair and begun to move with the tester order, walking over a distance of 3 meters, then circled around the second chair, later walked the same way over and sat down at their place. Test examiner turns on a timer Upon Tester getting up from a chair and turns it off after performing the above steps and Tester sitting on the chair, the time is calculated and recorded. According to Shopen, Grotagh, Goeken and Isma Timed up & go test is of appropriate validity in assessing mobility performance. Also highly correlated with the Berg Balance Scale (r= 0.81) and timed walk (r= 0.61) (Podsiallo et al., 1991). In the walking speed test, the subjects were asked to be placed behind the starting line and walk a 4 meter route by the command of tester. Tester turns on the timer at the beginning of the motion and the time of crossing the finish line is recorded. Timed walking test was used by Wade, wovdf Heller, Megz and Hyvvr (1987) to study patients who had myocardiol infarction (Wade et al., 1987). Their Investigation revealed the internal validity of 0.99 and the external validity of 0.90. Greene et al. (2002) conducted a study on patients with stroke one year later to examine the validity of the test. Their results showed validity of 0.95 to 0.99. Experimental group participated in the exercise three days a week for six weeks, while control group continued their habitual routine tasks. Selected balance training exercises chosen by the researchers included those activities necessary to perform on everyday tasks, and these patients were not able to do them easily. The exercises include standing on one leg, foot Stork standing on one leg forward and one leg back and when the heel of the front foot is in contact with the toe of the back foot, walk forward, walk backward and side walk, walk on a line, the stool up and down, moving in a circle, sitting and standing (with eyes open and eyes closed), carrying objects while walking, standing on one leg and throw the ball up and catch it, Go to the toe · heel and…. Finally, subjects were asked to do these exercises with eyes closed, if they can. Because the warm weather is harmful for patients, attempts have done to exercise at the optimal temperature for patients. Room temperature was 20 to 22 degrees Celsius on average. Also due to the fact that MS patients get tired very soon, rest intervals between exercises were carried over. Especially on the early days of practice, when patients were not accustomed to the exercises, they were devoted more time to relax. The subjects were advised to leave exercise and rest as soon as they feel tired. The exercise started with simple exercises, and gradually became more difficult with more time durations added. In the final stage, the subjects were asked to do some exercises with eyes closed. Data was analyzed using descriptive and inferential statistics. In the descriptive method, tables of data obtained from the experimental group and the control mean, and standard deviation and relevant charts were used to describe data. In inferential method, dependent t-test and repeated measure were used. Given that Subjects consisted of certain patients with MS recruited from the community, the researcher was faced with the following constraints: 1) disease recurrence was unpredictable in these; 2) sometimes patients after injection were faced with a severe imbalance and could not afford to do exercises well; 3) Sometimes patients experience severe fatigue caused by the disease and faced with the problem in doing exercises or test.

**Results**

Mean and standard deviation of balance in the two groups before and after the test period are presented in Table 1. according to figure 1 it is clear that there is an increased balance test means in the experimental group.

<table>
<thead>
<tr>
<th>Group</th>
<th>Test</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>Test 1</td>
<td>44.20</td>
<td>9.578</td>
</tr>
<tr>
<td></td>
<td>Test 2</td>
<td>46.20</td>
<td>8.066</td>
</tr>
<tr>
<td></td>
<td>Post test</td>
<td>51.10</td>
<td>4.954</td>
</tr>
<tr>
<td>Control</td>
<td>Pre test</td>
<td>44.50</td>
<td>8.541</td>
</tr>
<tr>
<td></td>
<td>Test 1</td>
<td>45.10</td>
<td>8.569</td>
</tr>
<tr>
<td></td>
<td>Test 2</td>
<td>44.50</td>
<td>8.141</td>
</tr>
<tr>
<td></td>
<td>Post test</td>
<td>44.30</td>
<td>8.233</td>
</tr>
</tbody>
</table>

**Table 1: Mean and standard deviation of balance in the two groups before and after the trial period**

**Graph 1. A balance comparison between experimental and control groups at the 4 tests**
Table 2: A comparison between 4 balancing test means in the experimental group

<table>
<thead>
<tr>
<th>Significance Level</th>
<th>F Value</th>
<th>Repeated measures statistics test</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.091</td>
<td>8.182</td>
<td>Test 1 with post-test</td>
</tr>
<tr>
<td>0.010</td>
<td>10.603</td>
<td>Test 2 with post-test</td>
</tr>
</tbody>
</table>

To study the difference in the balance test means in experimental group we use repeated measures method. Table 2 shows that except for test 1 and pre-test, there is a significant difference between each test in the experimental group, since significance level is less than .05. For a comparison between the experimental and control group means in each test, dependant t-test was used to determine that there are differences between which two tests of the two groups.

Table 3: dependent t-test of 4 balance tests means of both experimental and control groups

<table>
<thead>
<tr>
<th>Significance Level</th>
<th>F Value</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standard deviation</td>
<td>Mean</td>
</tr>
<tr>
<td>0.942</td>
<td>-0.074</td>
<td>8.581</td>
<td>44.50</td>
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<tr>
<td>0.827</td>
<td>-0.221</td>
<td>8.669</td>
<td>45.10</td>
</tr>
<tr>
<td>0.645</td>
<td>0.493</td>
<td>8.141</td>
<td>44.50</td>
</tr>
<tr>
<td>0.034</td>
<td>2.236</td>
<td>8.333</td>
<td>44.30</td>
</tr>
</tbody>
</table>

As Table 3 indicates there is only a significant difference between the last tests, namely post-test with a significant level of 0.05. Below is a balance progress chart of both groups.

Results and Discussions

The results of this study showed that six weeks selected balance exercises training improves balance in MS patients. The improvement was observed both dynamic balance and static balance, though it seemed that most of the patients show more improved dynamic balance than static balance. Patients before performing statistical analyzes even reported that they feel better balance and are also better able to walk. Also, they said that they could walk over longer distances than before. In addition, plying routes that were previously difficult now was more comfortable and had less fatigue when walking. Even some of the patients stated that they have better morale and higher confidence than before. In fact, the fear of falling was reduced in patients who had thus improving balance. The results of this survey are consistent with results obtained by Cattaneo et al. (2007). However, in Katanyo research experimental group was split into two groups and each group did certain balance exercises. A group practiced balance exercises to improve motor and sensory strategies and other group practiced balance exercises to improve sensory strategies. Both groups experienced significant improvement in their balance, though a group with balance exercises to improve motor and sensory strategies achieved better results. In the present study, the experimental group did balance exercises to improve motor and sensory strategies, and the results showed that exercise improves balance in MS patients. The results of this research is consistent with studies done by Jackson et al. (2002), Debolt & McQueen (2004), Kasser et al. (1991), Konrosdottir et al. (2007), Petajan et al. (1999). It needs to be mentioned the difference between the current Research with above researchers’ is that, this study is only used balance exercises, while others combined effects of physical exercise such as strength training, endurance and even stretching exercises, and flexibility on balance. Balance exercises used in this study improved the ankle, hip and steps walking strategies. For example, balance exercises such as standing on one leg like Stork stand up, stand on one leg so that one leg stretched out straight in front of body standing with a weight in hand or throwing a ball up and catching it while on one leg, and improves an ankle strategy. On the other hand, standing on one leg and bend forward from the waist, and standing on a soft surface improves hip strategy; going up or down from the stool, and crossed walk, standing with feet close together or one foot ahead of the other foot and push forward the examiner improved walking strategy (Bandy et al. (2001). In addition, balance training enhances the activity of somatic sensory system. It provides information about body parts conditions. Static Balance exercises increase receptor activity deep within the body and dynamic balance training improves motor and sensory receptors. For example, muscle motor units, thereby activated by increasing the activity of the muscle spindle muscle proprioceptive receptors. Muscle spindles are located between muscle fibers. Nerve endings that are wrapped around the central part of the muscle spindles transfer information to the spinal cord during stretch of this section to make up the central nervous system are aware of the length of the muscle. Sensory neurons in the spinal cord create synapse with motor neurons that cause reflected muscle contraction. In addition, through the action of the muscle spindles, muscle contraction increases (Hall et al., 2005). Another characteristic of balance exercises is recurrent property causes the nerve paths continually crossed. When doing these exercises, the nerve signals are constantly repeated and finally moved to unconscious part of the brain as a motor pattern, thus increasing the patient’s ability on that exercise and improves balance in patients. However, this practice does not have any effect on the damage caused on cerebella plaques and still movements of these patients is somewhat uncoordinated and uncontrolled (Bandy et al., 2001).

Conclusion

The results of this study showed that balance exercise alone can have a positive impact on improving MS patients. It is at this point that none of the research done have been reported about the effect of exercise outcomes on improving ailment and created plaques in the central nervous system. Physical exercises depending on the type of exercise training on muscles, affects on reflexive responses and cardiovascular systems.
Shari, G. et al.: Impact of six weeks selected balance exercises on improving multiple...

**References**


**UTJECAJ ŠEST TJEDANA IZABRANIH VJEŽBI RAVNOTEŽE NA POBOLJŠANJE RAVNOTEŽE PACIJENATA OBOLJELIH OD MULTIPLE SKLEROZE**

**Sažetak**


**Ključne riječi:** multipla skleroza, trening ravnoteže, ravnoteža, pokretljivost, brzina

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