Effect of balance training on postural stability for post mastectomy lymphedema

Karim Ibrahim saafan1,*, Zakaria Mowafy Emam 1 and Samy Ramzy Shehata2,

1Department of Physical Therapy for surgery, Faculty of Physical Therapy, Cairo University, Egypt
2Department of general surgery for oncology, national cancer institute, Cairo University, Egypt

*Correspondence: dr.karim.saafan@gmail.com Accepted: 16 Apr 2018 Published online: 26 June. 2018

This study was conducted to investigate the effect of balance training on postural stability for post mastectomy lymphedema. Forty female patients who had unilateral post mastectomy lymphedema with ages ranged from 40-60 years were selected randomly and divided into two equal groups in number each group contains 20 patients. Group (A): trained with biodex balance system (BBS) in addition to complex decongestive therapy inform of (Exercises, Manual lymph drainage, Bandaging and Skin care), 3 sessions/week for six weeks while patients in group (B): received only complex decongestive therapy. Patients in both groups were assessed before starting and after the end of 6 weeks (18th sessions) of training to measure postural stability indices in form of anteroposterior stability index (APSI) and mediolateral stability index (MLSI) using biodex balance system. Results: showed a statistically significant (P< 0.001) decrease in stability indices (Anterior/Posterior and Medial/Lateral) after the end of the balance training program. Conclusion: it could be concluded that balance training is an effective, safe and easy to be used for improving postural balance and decrease the risk of falling for post mastectomy lymphedema patients.

Keywords: (biodex balance training, APSI, MLSI and post mastectomy lymphedema).

INTRODUCTION

Postural sway is described as any deviation in the centre of gravity (COG) by leaning towards any direction on the supporting surface, and can be assessed by using a force platform. Many factors may cause degradation of postural stability by increasing postural sway such as disability of the sensory-motor system (Ruhe et al., 2011) as well as weight asymmetry such as amputation or unilateral volume change in the upper body (Bertels et al., 2012).

Post mastectomy lymphedema is the most common chronic impairment that affects patients’ quality of life following breast cancer surgery or radiotherapy. Lymphedema is the accumulation of protein rich fluid due to damage and/or obstruction in lymphatic vessels caused by lymph node dissection or surgery (Warren et al., 2007). Untreated lymphedema cause chronic inflammation, cellulitis, pain, stiffness, and impairment in the range of motion due to swelling and limb changes. In addition alteration in biomechanics of the thoracic-shoulder areas which can induce further upper body impairment that can lead to postural instability and imbalance (Shamley et al., 2009).

Balance is described as the ability to move with a weight bearing posture without falling. Also, balance is defined as, the ability to maintain the body’s center of gravity over its base of support (BOS). Good balance control exists when multiple systems (e.g visual, vestibular, sensory and motor systems) interact automatically, providing accurate and exact information to the nervous
Balance training and individualized muscle strength programs result in wide range of benefits. These include lower risk of falling, improve muscle strength and postural balance as well as maintain physical activity level (Robertson, 2005). Biodex Balance System (BBS) is a multi-axial device that objectively measures and records an individual's ability to maintain stability under dynamic stress. BBS has a movable platform that can be adjusted to provide varying degrees of stability and offers computer-based data (Hinman, 2000).

Postural instability due to unilateral post mastectomy lymphedema has greater impact on the patients' lives. There are difficulties in the workplace, doing physical and daily activities and getting a job. Thus, this study was conducted to determine the effect of balance training program on increasing postural balance and decreasing risk of falling in unilateral post mastectomy lymphedema patients.

**MATERIALS AND METHODS**

Forty female patients with unilateral post mastectomy lymphedema have participated in this study, with age ranged from 40-60 years. They all were free from diabetes, cardiopulmonary diseases, severe hypo or hypertension, visual and vestibular system affection. All subjects provided informed written consent, and the investigation was carried out in accordance with the Declaration of Helsinki. Patients were classified randomly into two groups (study and control groups) of equal number, 20 patients for each group. Group (A): trained with biodex balance system in addition to complex decongestive therapy of (Exercises, Manual lymph drainage, Bandaging and Skin care), while patients in group (B): received only complex decongestive therapy.

**Evaluative procedure:**

Dynamic balance was measured by using biodex stability system (Biodex medical systems Inc, Shirley, NY, USA). Patients in both groups were assessed before starting and after the end of 6 weeks of training to measure postural stability indices in form of anteroposterior stability index (APSI) and mediolateral stability index (MLSI).

**Training procedure:**

biodex balance training routine includes dynamic balance training programme; It was been performed in the same position used during testing (standing position). The subject was instructed to focus on the visually feedback screen directly in front of her and attempt to maintain the cursor at the center of the screen while standing on the unstable platform. Starting the biodex balance training sessions with the easier stability level (level 8) and progressed toward the most difficult stability level (level 1) according to the ability of each woman. Duration and frequency: 3 sessions per week for 6 weeks (18 sessions).

**Statistical Analysis:**

The data was summarized using descriptive statistics: mean and standard deviation and median values. Statistical differences between groups were tested using Chi Square test for qualitative variables, independent sample t test for comparison between pre and post treatment measures of APSI and MLSI between group A and B while nonparametric Mann Whitney test was used for comparing percent change of APSI and MLSI among studied groups. Paired t test was conducted for comparison between pre and post treatment measures of APSI and MLSI in each group. P- values less than or equal to 0.05 were considered statistically significant.

**RESULTS**

**Age:**

As observed in table (1) There was no significant difference between both groups in the mean age values (p = 0.53).

**Table 1: Comparison of the mean age values between group A and B:**

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>54.2 ± 6.1</td>
<td>52.95 ± 6.41</td>
</tr>
<tr>
<td>Minimum</td>
<td>41</td>
<td>40</td>
</tr>
<tr>
<td>Maximum</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>MD</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.53</td>
<td></td>
</tr>
<tr>
<td>Significance</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

\[ \bar{X} \]: Mean  
\[ SD \]: SD: Standard Deviation  
\[ MD \]: Mean difference

**APSI and MLSI improvement:**  
The analysis of the results of the current study showed: A significant decreases in the (APSI and MLSI) in the group (A) post treatment compared with pre
A significant decrease in the (APSI and MLSI) in the group (B) post treatment compared with pre treatment as shown in table (2) and (3).

**Table (2): The mean values of Anterior/Posterior Stability Index (APSI) before and after balance training program in group (A, B):**

<table>
<thead>
<tr>
<th>Variables</th>
<th>APSI group (A) Pre-training</th>
<th>APSI group (A) Post-training</th>
<th>APSI group (B) Pre-training</th>
<th>APSI group (B) Post-training</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>3.24</td>
<td>1.38</td>
<td>3.19</td>
<td>2.54</td>
</tr>
<tr>
<td>SD</td>
<td>±0.32</td>
<td>±0.4</td>
<td>±0.59</td>
<td>±0.57</td>
</tr>
<tr>
<td>% of improvement</td>
<td>57.4%</td>
<td>20.37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t- value</td>
<td>16.96</td>
<td>6.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P- value</td>
<td>0.0001</td>
<td>0.0001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

X: Mean SD: Standard Deviation  MD: Mean difference  APSI: Anteroposterior stability index

**Table (3): The mean values of Mediolateral Stability Index (MLSI) before and after balance training program in group (A, B):**

<table>
<thead>
<tr>
<th>Variables</th>
<th>MLSI group (A) Pre-training</th>
<th>MLSI group (A) Post-training</th>
<th>MLSI group (B) Pre-training</th>
<th>MLSI group (B) Post-training</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>1.95</td>
<td>1.05</td>
<td>2.08</td>
<td>1.77</td>
</tr>
<tr>
<td>SD</td>
<td>±0.16</td>
<td>±0.23</td>
<td>±0.49</td>
<td>±0.39</td>
</tr>
<tr>
<td>% of improvement</td>
<td>46.15%</td>
<td>14.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t- value</td>
<td>12.7</td>
<td>6.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P- value</td>
<td>0.0001</td>
<td>0.0001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

X: Mean SD: Standard Deviation  MD: Mean difference  MLSI: Mediolateral stability index

A significant decrease in the (APSI and MLSI) in the group A compared with group B post treatment as shown in figure (1) and (2).

**Figure. (1): Post treatment mean values of APSI of group A and B.**

**Figure. (2): Post treatment mean values of MLSI of group A and B.**
DISCUSSION

Forty female patients with unilateral post mastectomy lymphedema participated in this study to investigate the effect of balance training program on their postural balance. They had been received a balance training program for 6 weeks (3 sessions per week) using BBS. The stability indices (Anterior/Posterior and Medial/Lateral) of the dynamic balance test of BBS were used as a measurement for postural balance.

Increased APSI and MLSI in the present study before balance training program can be attributed to the surgery for unilateral mastectomy that may influence postural control and trunk static imbalance can occur, negatively affecting good posture. Changes to a body segment or posture result in displacement of the center of gravity, which can lead to instability (Findikcioglu et al., 2007).

In respect to the results of the present study, after the suggested period of balance training program (6 weeks), there was a statistically highly significant decrease in the mean values of all measuring variables of dynamic balance test. These results are also confirmed by (Salsabili et al., 2011) who reported that, training using sensory and reactive movement strategies with external visual feedback improves standing postural control in patients by modifying the subclinical constraints that contribute to disordered balance.

The six weeks of balance training program in this study at a rate of 3 times/week appears to be a sufficient period to promote reflex muscular activation patterns necessary for the maintenance of postural balance in unilateral post mastectomy lymphedema patients. This comes in consistency with (Alexander and Lapier, 2000), who proved that balance training program for only 6 weeks decreased pain and improved static as well as, dynamic balance in patients with low back pain. also it comes in agreement with (Steadman et al., 2003), who found that balance training program for only 6 weeks significantly improve balance, mobility, confidence and quality of life in patients with balance problems.

CONCLUSION

Finally it can be concluded that the significant improvement in the results of the study concerning the balance abilities in all measured parameters strongly proved the effectiveness of BBS and denoted the value of feedback balance training program in strength and proprioception, which are the main determinants of balance capabilities, also it should take into account that physiotherapy rehabilitation program after unilateral postmastectomy lymphedema should include balance training to improve the equilibrium reaction quality and increase the postural stability.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest".

ACKNOWLEDGEMENT

The authors would like to thank the staff members of physical therapy for surgery department at faculty of physical therapy Cairo University for their effort and support in our study.

REFERENCES

four studies”, Sport Rehab., 9: 240-252.