Effect of Cervical Stabilization Exercises on the Respiratory Function of Stroke Patients

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Abstract. This study was to investigate the effects of cervical stabilizing exercise and breathing retraining exercise to improve the respiratory function in elderly stroke patients. Experimental 1group performed cervical stabilizing exercise and respiratory breathing retraining exercise for 30 minutes in addition to the conventional exercise. Experimental 2group performed the respiratory breathing retraining exercise in addition to the conventional exercise and control group performed the self-respiration exercise for 30 minutes after the instruction of physiotherapist. Forced Vital Capacity showed significant differences not only between experimental 1group and control group, but also between experimental 2group and control group. This result may represent the improvement of overall respiratory function and it is believed that cervical stabilizing exercise accompanied with respiratory breathing retraining is helpful to improve activities of daily living and motor function by increasing respiratory function in stroke patients.

Keywords: Cervical stabilization exercise, breathing retraining, stroke patients

1 Introduction

Stroke, a chronic disease, is a neurological deficit resulting from the loss of blood supply due to infarction or hemorrhage in brain that may lead to functional disability. Furthermore, stroke is the main cause of death in the adult population over 40 years old, and even survivors suffer from decreased quality of life caused by impediments of physical function and activities of daily living [1], [2].

The importance of rehabilitation for elderly stroke patients has increased, and the difficulty and type of exercise for rehabilitation is influenced by age. The exercise program must be based on age and treatment period because the difficulty and type of exercise have a significant effect on physical function after rehabilitation [3].

Studies have reported that 40% of stroke patients who had respiratory disorder showed decreased electrical activation, and 50% had lower forced vital capacity...
(FVC), forced expiratory volume at one second (FEV1), and peak expiratory flow (PEF) levels than normal adults. Furthermore, oxygen saturation in arteries and the respiration pattern changed; thus, stroke patients show fatigue quickly in the inspiration muscles and have a higher rate of respiratory complications [4].

Studies on breathing retraining and stabilization exercises for the cervical region are lacking. Thus, the purpose of this study was to investigate the effects of cervical stabilization and breathing retraining exercises to improve respiratory function in stroke patients.

2 Material methods

The participants performed the exercises five times a week for 6 weeks after general characteristics were confirmed. All subjects performed conventional exercises consisting of range of motion (ROM), stretching, strengthening, and balance exercises and gait training for 30 min in each session.

Experimental group 1 performed cervical stabilization and respiratory breathing retraining exercises for 30 min in addition to the conventional exercises. Experimental group 2 performed respiratory breathing retraining exercises in addition to the conventional exercises, and the control group performed self-respiration exercises for 30 min after the group received instructions from the physiotherapist. Assessments were conducted before and after the intervention for statistical analysis.

Respiration function was assessed using a Cardio Touch 3000S (BIONET). Micro RPM was used to assess respiratory pressure. In this study, SPSS Windows (version 20.0) was used to investigate the subjects’ general characteristics. In addition, one-way ANOVA was also used to investigate the differences among groups. Post-hoc analysis was conducted using least significant differences (LSD), and the significance level was 0.05.

3 Results

In each group, there were statistically significant changes in the FVC, FEV1, MIP, and MEP before and after the intervention. That is, each exercise may have had a positive effect on the FVC, FEV1, MIP, and MEP, and provide an effective approach for stroke patients with respiration disorders. However, there was no significant change in FEV1 to FVC ratio (Tables 1).

Table 1. Comparative analysis between the groups (Mean ± SD)

<table>
<thead>
<tr>
<th></th>
<th>CS+BR</th>
<th>BR</th>
<th>Control</th>
<th>p</th>
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<tbody>
<tr>
<td>FVC</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pre</td>
<td>1.76±0.34</td>
<td>1.80±0.37</td>
<td>1.62±0.31</td>
<td>.348</td>
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<td>6weeks</td>
<td>2.68±0.27</td>
<td>2.49±0.27</td>
<td>1.87±0.49</td>
<td>.000*</td>
</tr>
<tr>
<td>FEV1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>1.39±0.27</td>
<td>1.36±0.25</td>
<td>1.31±0.53</td>
<td>.847</td>
</tr>
</tbody>
</table>

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Values are Mean±SD mean±standard deviation.
Abbreviations: CS, cervical stabilizing group; BR, breathing retraining group; FVC, forced vital capacity; FEV1, forced expiratory volume at one second; MIP, maximal inspiratory pressure; MEP, maximal expiratory pressure.
*P < .05.

4 Discussion

This study was conducted to find the beneficial effects of breathing exercises on breathing ability for hemiplegic patients with stroke, a medical condition that can lead to dementia, who were divided into a group who applied breathing retraining exercises combined with cervical stabilization exercises (experimental group1), a breathing retraining group (experimental group2), and a control group who performed self-breathing exercises after receiving instruction from the therapist.

Respiration is one of the most important functions for human life, patients’ functional ability must be assessed, to diagnose disease and to investigate the prognosis with cardiopulmonary function measurements. Aging can change sensorimotor processing, and the older neuromuscular system is weakened by 40% compared to normal healthy adults [5]. The problems of chronic stroke patients include weakness of the cardiovascular system and decreased physical function and respiratory function that decreases gait and activities of daily living [6].

The physical activities and emotional disorder of older hemiplegic patients could not be prevented, but adequate physical activities and exercise combined with regular breathing have been reported to have positive effects on physical as well as emotional functions [7]. Thus, in this study, FVC, FEV1, the FEV1 to FVC ratio, MIP, and MEP were used to compare and measure the respiratory function of stroke patients. These measurements are widely used in the clinical setting and have lower variability than other respiratory indices [8].

Patients who have chronic cervical pain have been reported to complain about decreased respiratory function related to postural change such as the forward head posture [9], and another study showed that the FVC was significantly decreased [10].
Based on these studies, the combination of cervical stabilization and respiratory breathing retraining exercises resulted in the improved FVC for experimental group 1.

In the results of this study, there were statistically significant differences in all variable items. This result may represent an improvement in overall respiratory function, and cervical stabilization exercises accompanied by respiratory breathing retraining is helpful to improve activities of daily living and motor function by increasing respiratory function in stroke patients. In addition, this intervention is an effective respiratory physical therapy, and further study is needed to increase the clinical application.

References