The Effects of Lee Silverman Voice Treatment Combined with Abdominal Respiration on Maximum Phonation Time in Parkinson’s Disease

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LSVT와 복식호흡의 동시적 적용이 파킨슨병 화자의 노력성
폐활량, 음성강도, 최대연장발성시간에 미치는 효과

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요 약

The purpose of the our study was to evaluate the effects of a respiratory rehabilitation the forced vital capacity, voice intensity, and maximum phonation time (MPT) of patients with hypokinetic dysarthria. This study was carried out on 32 patients with Parkinson’s disease (PD). All subjects were randomly assigned to a treatment group (n = 17), which received both abdominal breathing training and LSVT, and a control group (n = 15), which only received abdominal breathing training. The forced expiratory volume at one second (FEV1) was measured in the sitting position. The coordination of respiration and vocalization was measured by using MPT. The results of ANCOVA, which controlled the pre-test with a covariate, showed that the control group (CG) and the treatment group (TG) were significantly different (p<0.05) in FEV1, MPT, and vocal intensity. The results of parameter estimation revealed that the TG had significantly longer MPT (1.9 seconds longer on average) than the CG and the vocal intensity of the TG was significantly stronger (3.1dB higher on average). On the other hand, FEV1 significantly increased in the TG and the CG after 4 weeks of treatments compared to the baseline. However, there was no significant difference between TG and CG. The respiratory rehabilitation composed of LSVT and abdominal breathing was effective in improving not only the vocal intensity of patients with PD but also the coordination of respiration and vocalization.

1. Introduction

The Lee Silverman Voice Treatment (LSVT) is widely used as a treatment to enhance the coordination between the respiration and voice of patients with Parkinson’s disease (PD), in the language rehabilitation field.[1] LSVT is a method that is designed to enhance the loudness of patients and it has been proven to be effective for improving the speech intelligibility of patients with PD [2]. It is a systematic rehabilitation method that helps patients generate much stronger and louder voice than the patients could generate themselves [2]. Previous studies have reported that LSVT increased the loudness of patients with PD and was also effective in improving vocal cord vibration, voice quality, pitch inflection, breathing capacity, and swallowing function [3,4].

Recent studies have proposed that a rehabilitation program that integrates interventions related to respiration would be more effective in improving the functional activities of patients with neurological impairment such as stroke than a single-treatment program [5]. Nonetheless, there is not enough evidence on the effects of LSVT on the lung capacity and the coordination between the respiratory muscle and musculolaryngis of patients with PD. Moreover, only a few studies evaluated the effectiveness of comprehensive rehabilitation programs to enhance the respiratory capabilities of patients with PD.

The objective of this study was to evaluate the effects of a respiratory rehabilitation program (four weeks of abdominal breathing training and LSVT) on the forced vital capacity, voice intensity, and maximum phonation time (MPT) of patients with PD accompanied by hypokinetic
2. Methods

2.1. Participants

This study was carried out on 32 patients with PD who received rehabilitation treatments in hospitals located in Seoul and Incheon between August and December 2016. All subjects were randomly assigned to a treatment group (n = 17), which received both abdominal breathing training and LSVT, and a control group (n = 15), which only received abdominal breathing training.

2.2. Measurement

The forced expiratory volume at one second (FEV1) was measured in the sitting position by using Micro-Quark (COSMED, Albano Laziale, Italy). The coordination of respiration and vocalization was measured by using MPT. MPT is a measurement index for identifying the coordination of them quantitatively. It measures the time in seconds that a subject makes /a/ sound as long as possible with maintaining a constant tone and intensity in a relaxed state. The vocal intensity was analyzed by averaging the 3-second continuous sound interval using Praat ver 5.1 (Boersma & Weenink, 2007).

A treatment was considered as an explanatory variable, FEV1, MPT, and vocal intensity were treated as outcome variables, and the baseline was defined as a covariate. The changes in outcome variables before and after treatment were compared using one-way ANCOVA. All statistical analyses were conducted using R version 3.4.4: Windows.

3. Results

Pre-test and post-test were performed to identify the changes in the breathing capacity of the treatment group and the control group by treatment method [Table 1]. First, the interaction between the pre-test and treatment was analyzed to determine whether the data satisfied the assumptions of ANCOVA. Since the interaction was not significant, it was confirmed that the slope of pre-test regression was identical between the two groups. Moreover, the Levene test for testing the homoscedasticity also showed that the variances of the two groups were the same.

The results of ANCOVA, which controlled the pre-test with a covariate, showed that the control group and the treatment group were significantly (p<0.05) different in FEV1, MPT, and vocal intensity. The results of parameter estimation revealed that the treatment group had significantly longer MPT (1.9 seconds longer on average) than the control group and the vocal intensity of the treatment group was significantly stronger (3.1dB higher on average). On the other hand, FEV1 significantly increased in the treatment and control group after 4 weeks of treatments compared to the baseline. However, there was no significant difference between treatment and control groups.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Control group</th>
<th>Treatment group</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1</td>
<td>2.15±0.51</td>
<td>2.31±0.50</td>
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<td>MPT</td>
<td>16.28±2.35</td>
<td>17.31±2.83</td>
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<td>Intensity</td>
<td>45.52±3.31</td>
<td>47.32±4.35</td>
<td>6.853</td>
<td>0.025</td>
</tr>
</tbody>
</table>

* Control group= abdominal breathing treatment; Treatment group= abdominal breathing and LSVT treatments

4. Conclusion

The respiratory rehabilitation composed of LSVT and abdominal breathing was effective in improving not only the vocal intensity of patients with Parkinson’s disease but also the coordination of respiration and vocalization. It will be necessary to develop and apply a comprehensive rehabilitation program combining the abdominal breathing and LSVT in order to improve the support of breathing and the maintenance of vocalization of patients with Parkinson’s disease.

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References


