The Effect of Simultaneous Application of Tongue Pressure Training and Tongue Base Exercise on the Improvement of Strength of Tongue and Lips in Korean Patients with Flaccid Dysarthria

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The objective of this study was to identify the effects of the tongue-pressure exercise protocol and the traditional orofacial exercise on the articulation muscle and percentage of correct consonants of the patients with dysarthria. This study was performed on 21 patients who were diagnosed with flaccid dysarthria due to stroke. The subjects were randomly divided into a control group (tongue-pressure protocol only; n=11) and a treatment group (tongue-pressure protocol and tongue base exercise; n=10). The maximal tongue strength (kPa) and the maximum lip strength (kPa) were estimated by measuring those three times and choosing the highest number. The results of ANCOVA showed that the maximal tongue strength, maximal lip strength, and articulation accuracy were significantly different between the two groups (p<0.05). The results of parameter estimation revealed that the treatment group had 3.5 kPa higher maximal tongue strength and 1.0 kPa higher maximal lip strength than the control group. On the other hand, the correct articulation (%) was higher in the post-test than the pre-test in both groups, but there was no significant difference between groups. The results of this study showed that the combined rehabilitation program consisting of the tongue-pressure protocol and tongue base exercise improved the maximal tongue strength and maximal lip strength significantly more than the single rehabilitation program consisting only of the tongue-pressure protocol.

1. Introduction

The ultimate goal of the speech intervention strategy of dysarthria speakers is to improve the clarity of articulation [2]. Therefore, it focuses on treating abnormal sounds or changing the major variables of articulation characteristics [9]. Previous clinical studies have focused on controlling the changes in rhythm [10], the articulation speed [11], and the training for increasing the vocal intensity [12] of speakers with dysarthria. Particularly, patients with flaccid dysarthria among patients with dysarthria experience difficulties in speech due to various clinical characteristics (e.g., weakness, hypomytonia, and shrinkage of the oral articulation organ) [13]. The oral articulation organ includes the tongue, lips, and velum and the motor functions of the tongue and lips are important in a speech [2].

The objective of this study was to identify the effects of the 4-week long the tongue-pressure exercise protocol and the traditional orofacial exercise on the articulation muscle and percentage of correct consonants of the patients with dysarthria due to the stroke. The results of this study will provide baseline data for establishing the basis of the non-oral motor therapy for the patients with flaccid dysarthria.

2. Methods
2.1. Subjects

This study was performed on 21 patients who were diagnosed with flaccid dysarthria due to stroke in Seoul and Incheon rehabilitation hospitals from October 01, 2017, to January 31, 2018. The subjects were randomly divided into a control group (tongue-pressure protocol only: n=11) and a treatment group (tongue-pressure protocol and tongue base exercise: n=10).

2.2. Measurement

2.2.1. Tongue-Pressure Training Protocol

The conducted tongue-pressure training protocol consisted of isometric tongue strength exercise and isometric tongue accuracy exercise by using Iowa Oral Performance Instrument 8-2201 (IOPI, Carnation WA: IOPI medical, USA). IOPI is an instrument to exercise by pressing the air filled bulb, located on the palate, with the tongue 19, 24, 25. This rubber bulb is located at the front or back of the mouth and shows the pressure (kPa, kilopascals) on the connected LCD. The tongue-pressure training protocol consisted of two exercise programs based on Yeates et al. (2008)

2.2.2. Orofacial Exercise

The tongue based exercise was used for the orofacial exercise. The tongue based exercise instructs a tongue movement to a patient and the patient performs the movement. The control conducted the tongue-press training protocol 30 minutes per day and five times per week for four weeks.

2.2.3. Statistical Analysis

ANOVA used the maximal tongue strength, maximum lip strength, and consonant accuracy, which were pre-scores, as covariates to analyze the changes in the outcome variables after treatments. All statistical analyses were conducted using IBM SPSS version 250 (IBM Inc., Chicago, IL, USA).

3. Results

Pre-test and post-test were conducted to the treatment group (tongue-pressure protocol & tongue base exercise) and the control group (tongue-pressure protocol) in order to identify the changes in maximal tongue strength, maximal lip strength, and articulation accuracy by the intervention method (Table 1). The interaction between the pre-test and treatment was analyzed in order to test if the data satisfied the basic assumptions of ANCOVA. The results showed that the interaction was not significant so it was confirmed that the pre-test and the slope of the regression analysis were identical between the two groups. Moreover, the Levene test revealed that their variances were homogeneous.

The results of ANCOVA showed that the maximal tongue strength, maximal lip strength, and articulation accuracy were significantly different between the two groups (p<0.05). The results of parameter estimation revealed that the treatment group had 3.5 kPa higher maximal tongue strength and 1.0 kPa higher maximal lip strength than the control group. On the other hand, the correct articulation (%) was higher in the post-test than the pre-test in both groups, but there was no significant difference between groups.

[Table 1] Changes in maximal tongue strength, maximal lip strength, and articulation accuracy according to intervention method

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTS, kPa</td>
<td>11.38±</td>
<td>17.92±</td>
<td>10.76±</td>
<td>20.80±</td>
</tr>
<tr>
<td>MLS, kPa</td>
<td>6.10±</td>
<td>9.30±</td>
<td>5.86±</td>
<td>10.13±</td>
</tr>
<tr>
<td>CA, %</td>
<td>76.48±</td>
<td>79.13±</td>
<td>73.15±</td>
<td>77.47±</td>
</tr>
</tbody>
</table>

MTS= maximal tongue strength; MLS= maximal lip strength; CA=correct articulation

4. Conclusion

The results of this study showed that the combined rehabilitation program consisting of the tongue-pressure protocol and tongue base exercise improved the maximal tongue strength and maximal lip strength significantly more than the single rehabilitation program consisting only of the tongue-pressure protocol. However, there was no difference in the correct articulation between the two groups. Although the correct articulation is related to the
strength of the tongue and lips, it reflects various elements required for speech production such as respiration, resonance, and vocalization in addition to articulation muscles. Future studies are needed to analyze additional variables such as respiration and resonance in addition to correct articulation in order to examine the combined effects of the tongue-pressure protocol and tongue base exercise on the speech production of the patients with dysarthria.

Acknowledgments

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education(NRF-2018R1D1A1B07041091).

References


