Original Article

Difference in tongue strength using visual feedback in healthy adults

Ji-Hoon Kim1), Jae-Wan Choi2), Sang-Hoon Lee3), Young-Seok Cho4)*

1) Department of Occupational Therapy, Gimcheon University, Republic of Korea
2) Department of Occupational Therapy, Graduate School of Inje University, Republic of Korea
3) Department of Rehabilitation Science, Graduate School of Inje University, Republic of Korea
4) Department of Occupational Therapy, Hyejeon College: 18-23 Daehak-gil, Namjang-ri, Hongseong-eup, Hongseong-gun, Chungcheongnam-do, Republic of Korea

Abstract. [Purpose] This study investigated the difference in tongue strength with and without visual feedback in healthy adults. [Subjects and Methods] A total of 30 healthy adults were recruited. We measured the strength of the anterior region of the tongue before and after applying visual feedback using the Iowa Oral Performance Instrument. [Results] The tongue strength was measured as 45.5 ± 9.3 kilopascals with visual feedback and 41.1 ± 8.6 kilopascals without visual feedback, showing a statistically significant difference. [Conclusion] Visual feedback may be an effective tool for increasing the strength of the tongue.

Key words: Tongue, Visual feedback, Iowa Oral Performance Instrument

INTRODUCTION

Tongue strength exercise in patients with dysphagia has recently been reported as a remedial method1). Strength training of the tongue can be performed by pressing the tongue against the palate and using a pressure sensor1, 2). Tongue strength training has shown positive effects on tongue strength as well as improved pharyngeal phase1, 3). Therefore, strategies to effectively train tongue strength are important.

Visual feedback (VF) is applied in various areas for successful rehabilitation. VF allows the participant to know their current force production in real time using visual information, and it can help reduce errors. It can also help motivate the participant to make more efforts while training4). Therefore, if VF is applied to tongue strength training, a greater improvement in function can be expected.

The Iowa Oral Performance Instrument (IOPI; Medical LLC, Carnation, WA, USA) is a tool used for training purposes, as well as measuring the strength of the tongue2). It displays the pressure generated by a pressure sensor in real time. VF is also possible because the power of the 8 lamps can be observed on the front of the tool. Therefore, this study aimed to investigate the effect of VF on the measurement of tongue strength in healthy adults using IOPI.

SUBJECTS AND METHODS

This study was conducted on 30 healthy adults (15 men; 15 women; age range, 22–35 years). The participants were all healthy volunteers with no reported neurologic or structural damage affecting oropharyngeal swallowing function. The purpose of the study was explained to the participants before enrollment, and informed consent for participation was obtained in accordance with the principles of the Declaration of Helsinki. Tongue strength was measured by an experienced occupational therapist using IOPI. The IOPI includes a tongue bulb, a connecting tube, a main body, and a pressure port. The bulb is made...
of soft rubber and filled with approximately 2.8 ml of air, and it is connected to the IOPI body by an 11.5 cm flexible tube. The bulb is approximately 3.5 cm in length, 1.5 cm in breadth, and 3.5 cm in girth. Values are measured in kilopascals.

The anterior region of the tongue was used to measure strength. The pressure bulb was positioned on the hard palate immediately behind the upper gums, touching the front 10 mm of the tongue dorsum. Participants were instructed to press the bulb toward the hard palate with the tongue, as hard as possible, for 2 to 3 s. The maximum muscle strength was measured three times in succession, and the average value was recorded. For the purposes of hygiene, the bulb was placed inside a new plastic glove for each measurement. The bulb used a new bulb each time to maintain a constant state. Measurements were performed three times with VF and three times without VF. The order of the measurements was the coin throwing method. Two types of VFs were provided in this study. IOPI’s body provided an amount of force that is generated through the LCD window. In addition, the IOPI main unit has eight lamps positioned vertically. As more power is generated, more lamps would be ignited. All statistical analyses were performed with SPSS 15.0 software (SPSS Inc., Chicago, IL, USA). Descriptive statistics are presented as means ± standard deviation. The Shapiro-Wilk test was used to check normality of the outcome variables. The paired t-test was used to compare the strength with VF and without VF. Significance level was set at p<0.05.

RESULTS

The tongue strength was measured as 45.5 ± 9.3 kilopascals with VF and 41.1 ± 8.6 kilopascals without VF, showing a statistically significant difference (p<0.05).

DISCUSSION

This study investigated the effect of VF on tongue strength. The results of this study showed that the tongue strength was higher when the VF was applied than when VF was not applied. Previous studies have reported that VF is beneficial in increasing muscle contraction and muscle activation5, 6. Park et al.7 reported that breathing exercise with VF improved pulmonary function and increased respiratory muscle activity. Prior studies demonstrated the effect of VF on various muscle activities but tongue muscle activity was never investigated previously. VF helps participants by showing the amount of force currently being generated. It is a useful tool for increasing participant effort and motivation. Using VF seems to provide the subjects with more motivation to generate greater force. This study confirmed that VF may be an effective tool for increased strength of tongue. Limitations of this study is that only included healthy subjects, and for future study is suggested on subjects with dysphagia.

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