

The Effects of Lingual Exercise on Swallowing in Older Adults. (Robbins et al. 2005)

Background As many as 40% of adults 60 years and older currently suffer from dysphagia.

Pneumonia is a leading cause of death in older patients, and associated with dysphagia.

Sarcopenia is defined as age-related decrease in skeletal muscle mass which leads to decrease in muscle strength, power and functional decline.

The tongue is comprised of a mass of muscles that play a major role in swallow function and is not immune to the effects of sarcopenia. The assumption is that sarcopenia of the tongue muscles contributes to the development of dysphagia in the elderly, that exercise may prevent and reverse sarcopenia, and that tongue exercise may therefore be a valuable therapeutic tool for dysphagia in the elderly.

This study set out to assess whether older adults who complete an 8 week progressive resistive lingual exercise program will demonstrate:

1. Increased lingual isometric strength
2. Increased lingual strength and pressures generated during swallowing
3. Increased lingual mass volume and functional swallowing outcomes

Study Design

Subjects 10 healthy older adults: 4 men and 6 women; ages 70-89 with no history of swallowing complications.

Methods Subjects received an 8 week lingual exercise program using the IOPI¹; 30 repetitions, 3 x per day for 3 days per week. Pressure measurements were taken at Weeks 2, 4, and 6.

¹ IOPI = Iowa Oral Performance Instrument. Measures tongue pressure using an air filled bulb that is placed on the tongue blade, between the tongue and hard palate. This bulb is connected by way of plastic tubing to a pressure biofeedback device that measures the pressure change in the tubing. The user is alerted to successful achievement by a series of lights changing from red to green, as well as with numbers.

Measurements Pressures were measured during two conditions: isometric exercise and swallowing.

1. Oral pressures generated during the isometric exercise were measured using the IOPI.
2. Swallowing pressures were measured using 3 air-filled bulbs taped to the hard palate and connected to a Digital Swallowing Station for recordings.
3. Swallowing function was evaluated during an MBS study while the participants performed a total of 11 swallows under 4 randomized conditions: 3 swallows each of 3 mL of thin liquid, 10 mL of thin liquid, and 3 mL of a semisolid; and 2 effortful swallows of a 3 mL of thick liquid. Measures for residuals and duration were taken during these trials using scales and measures that have not been tested for reliability.

The Penetration/Aspiration Scale, a valid measure, was used to measure the presence and degree of penetration and aspiration during the trials.

Lingual Mass Volume (the size of the tongue) was measured using MRI in 4 of the participants.

Results

1. Isometric pressures significantly increased as measured by the IOPI.
2. Peak swallowing pressures greatly increased as measured by the 3 bulb strip used during the MBS. There was a measured increase in swallow pressures during the swallow for 10ml of thin liquid, semisolids, and in an effortful swallow.
3. In the 4 individuals that participated in the MRI, there was an increased lingual volume by an average of 5.1%. There was little change in overall swallow function per the measure of residuals and pen/asp. The authors report that this finding would be expected given that these individuals demonstrated a normal, functional swallow at the baseline evaluation. (Page 5-6).

Discussion

“Healthy older individuals successfully and significantly increased their lingual maximal isometric pressure over an 8-week period of exercise following a traditional sports medicine protocol.” (Page 5-Discussion)

There was spontaneous carryover of this increased isometric pressure to the swallow pressures; in other words, the subjects were able to push harder with their tongue during exercise and as a side effect, their swallow pressures increased as well. This is significant in that the tongue is a major propulsive force to drive the bolus and is a major generator of pressure for swallow function. The older adults who participated in the program reported a sense of empowerment and satisfaction in participating in an exercise program.

Exercise has been shown before to be able to reverse the effects of aging on striated muscles in the limbs. This study suggests that the same effect can be had on the tongue muscles. This data is important with regards to the treatment of dysphagia as it provides the treating clinician with a better understanding of the impact of aging on a striated muscle system such as the tongue. This data further shows that exercise can prevent and reverse these effects.

Resistive exercise per a defined regimen is necessary to facilitate these positive changes. The use of modalities as an adjunct to this exercise program has been shown to be effective in the limbs and now the tongue muscles.

The strengths of this study include the fact that a healthy population was included, with no prior report of swallowing difficulty. This is important for two reasons: first, these hypotheses need to be tested in normal, aging individuals before they are tested in an impaired set of individuals; and second, given the absence of conflicting health related variables, a protocol can be established and tested in the normal group before applying it to the impaired group. Another strength of this study is that an established protocol and regimen were used. The authors designed the strength training regimen based on guidelines of the American College of Sports Medicine.

The limitations of this study include the fact that non-validated swallowing measures were utilized during the MBS to assess residuals and duration of the bolus.

Reference

Robbins J, Gangnon RE, Theis SM, Kays SA, Hewitt AL, and Hind JA. The effects of lingual exercise on swallowing in older adults. *J Am Geriatr Soc* 53: 1483-1489, 2005.