

Effects of Respiratory Muscle Strength Training and Shaker Exercise on Swallow Function: A Systematic Review



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Background

Question: In adult patients with dysphagia, how does Respiratory Muscle Strength Training compare to the Shaker exercise in improving functional outcomes of swallowing?

Oropharyngeal dysphagia is a dysfunction of swallowing which can affect the ability of a bolus to move from the oral cavity through and into the esophagus. This is a common issue among individuals with neurologic conditions as well as elderly adults and can cause complications such as aspiration pneumonia, malnutrition, dehydration, and possibly death. This systematic review explores two leading therapy exercises that are being used to improve the symptoms of oropharyngeal dysphagia: Respiratory Muscle Strength Training (RMST) and the Shaker Exercise (also commonly referred to as head lift). RMST is an exercise technique that targets the inspiratory and expiratory muscles to increase the amount of air pressure an individual can generate. The Shaker Exercise focuses on strengthening the suprahyoid and infrahyoid muscles to promote upper esophageal sphincter (UES) opening.

Methods

Databases searched:

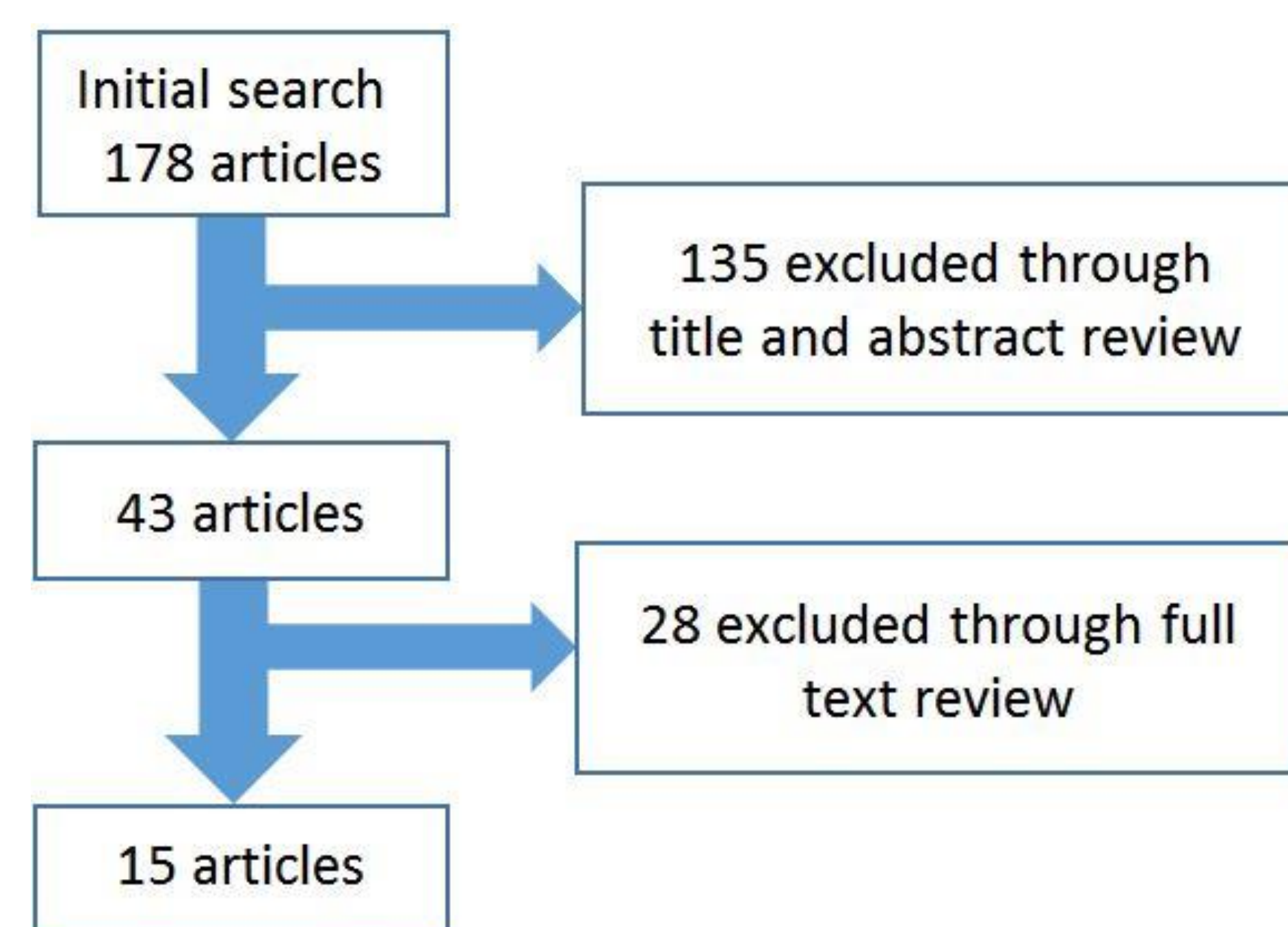
- PsychInfo, CINAHL Plus, PubMed

Search terms used:

- Adult, patient, client
- Dysphagia, deglutition, swallow
- Shaker, head-lift, RMST, respiratory muscle strength training, inspiratory muscle strength training, expiratory muscle strength training, EMST, IMST

Inclusion Criteria:

- English language
- Peer-reviewed
- Adult participants with dysphagia
- Utilizes head lift/Shaker exercise and/or RMST, IMST, or EMST
- Measured the effects on swallowing
- Publication prior to February 14, 2017



Shaker Exercise Results

Author and Year	Sample	Results
Antunes, 2012	9 original research studies	Several studies concluded that the Shaker exercise was effective or neutral in reducing symptoms of dysphagia. It will be difficult to make such broad conclusions due to the many causes of dysphagia.
Kim, 2014	26 with history of stroke	Both Shaker group and comparison group made statistically significant improvement in premature bolus loss, residue in the valleculae, laryngeal elevation, epiglottic closure, residue in the pyriform sinuses, coating of the pharyngeal wall after swallowing, pharyngeal transit time, and aspiration. The Shaker exercise may not be appropriate for those who are susceptible to neck pain.
Gao, 2016	90 with history of stroke	Both the Shaker and CTAR group had significantly improved VFSS scores only between weeks 2 and 4. Both the Shaker group and the comparison group had a significant decrease in SDS score after the 6 week intervention.
Logemann, 2009	19 with history of stroke or CRT for head and neck cancer	Greater reduction in post-swallow aspiration in Shaker group compared with traditional treatment group. After traditional therapy, significant increase in superior hyoid and laryngeal movement and anterior laryngeal movement. Both groups showed a significant increase in width of UES.
Mano, 2015	6 with spinal and bulbar muscular atrophy (SBMA)	Shaker exercise significantly increased tongue pressure values. Oral-phase items of the SDQ also decreased. No significant change was found in the pharyngeal phase. The Shaker exercise may improve swallowing dysfunction in patients with SBMA.
Mepani, 2009	11 with history of stroke or head and neck cancer	Shaker exercise resulted in significantly greater change in thyrohyoid distance than traditional therapy. Authors were unable to illustrate that this aided in UES opening.
Ohba, 2016	51 with advanced head and neck cancers	Shaker group did not make progress, but maintained current levels while control group declined. Shaker can help preserve intra- and post-CRT treatment swallowing function in patients with advanced H&N cancer.
Park, 2017	37 with history of stroke	Group receiving Shaker demonstrated significant increase in superior movement of the hyoid bone over the control group. The Shaker group performed significantly better on liquids than the control group when final results were compared.
Shaker, 2002	27 with dysphagia secondary to abnormal UES opening	Participants who received the Shaker exercise could more adequately manage and clear secretions than those in the sham exercise group. All participants in the Shaker group demonstrated significant increases in the anteroposterior diameter of the UES, maximum anterior laryngeal, as well as FOAMS score. Muscle group specific exercises can have a significant positive effect on the rehabilitation of swallow function.

*Studies in red failed quality appraisal due to a variety of reasons, and were not included in our analysis

RMST Results

Author and Year	Sample	Results
Byeon, 2016	33 with Parkinson's Disease	The group which received both postural exercises and EMST had a greater reduction in VFS scale score than the group which received exclusively EMST.
Guillén-Solà, 2016	62 with subacute ischemic stroke within 1-3 weeks of inclusion	All groups showed significant increase in respiratory pressure and swallowing safety, but effect was no longer present after 3 months. Adding RMST to other therapy was effective in improving respiratory muscle strength.
Hegland, 2016	14 with ischemic stroke within the preceding 24 months	Maximum expiratory pressure (PeMax), reflex cough, and urge to cough increased in all participants post-training. No significant changes in measures of swallowing function.
Park, 2016	33 with stroke within the last 6 months	Group receiving EMST showed greater improvement in use of suprahyoid muscles and in PAS score for liquids and semisolids than the group receiving training using a sham.
Pitts, 2009	10 with midstage Parkinson's Disease	PA scores significantly decreased and PeMax scores significantly increased after training.
Troche, 2010	72 with idiopathic Parkinson's disease	PA scores were significantly lower following EMST treatment. Duration of hyoid movement shortened in the sham group significantly but did not change in the EMST group. There was an improvement in swallowing related quality of life not correlated to group-affiliation.



Fig. 1 Demonstration of Shaker exercise

Fig. 2 EMST device

Clinical Implications

- Both the Shaker exercise and RMST have a positive effect on swallowing function and may reduce the risk of complications associated with dysphagia.
- The Shaker exercise has limited application to patients with sensitivity in the head, neck, or back regions.
- Positive swallowing outcomes promote improved patient quality of life and shorter hospital stays.
- RMST may result in a more effective cough and the Shaker exercise can strengthen neck muscles to improve airway protection and UES opening.
- Depending on level of impairment, these exercises may be completed independently.
- The results of this systematic review may help clinicians determine patient candidacy for these exercises.

Discussion

Evidence from this synthesis illustrates that both the Shaker method and RMST have different, yet positive outcomes regarding the swallowing mechanism. However, most studies did not determine the lasting effects of the exercise and only measured outcomes in a 4-6 week trial period. This indicates a greater need for studies with longer follow-up periods to determine if these functional outcomes persist over time.

Only 15 articles ranging from poor to high quality met the final inclusion criteria. Of these, 10 were randomized controlled trials (RCT), 4 were quasi-experimental studies (non-randomized experimental studies), and 1 was a systematic review. In order to draw reliable conclusions, further research comprised of high quality, randomized controlled trials are needed.

Additionally, studies which directly compared the outcomes of these two exercises were not found during our search process. Given the popularity of these methods, it may be of clinical importance to directly compare the effects of these treatments on specific swallow outcome measures.

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The authors have no financial or intellectual conflicts of interest. References available upon request: emily_bragg@med.unc.edu