

Biofeedback Techniques in the Treatment of Dysphagia

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Background

Research Question: “In adults with dysphagia, do biofeedback techniques improve therapy outcomes?”

The patients within our systematic review acquired dysphagia as a result of: Alzheimer’s Disease, Parkinson’s Disease, Stroke, Head & Neck Cancer, and other unspecified neurologic injuries. Dysphagia is difficulty with swallowing. Biofeedback can be defined as the technique of using equipment to reveal to patients some of their internal physiological events, normal and abnormal, in the form of visual and auditory signals. This allows the patient to learn how to manipulate these otherwise involuntary or unfelt events (Bogaardt, Grolman, & Fokkens, 2009). The biofeedback techniques used within our systematic review include: digital accelerometry, surface electromyography (sEMG), ultrasonography, neuromuscular electrical stimulation, mechanomyography, high-resolution pharyngeal manometry, and visual biofeedback. Within the present literature, there is limited reliable research regarding the efficacy of biofeedback techniques in the treatment of dysphagia. The purpose of this systematic review was to examine biofeedback techniques alone, or in combination with various swallowing therapy techniques in order to determine their effectiveness in improved therapy outcomes.

Methods

Databases Searched:

- PubMed
- CINAHL

Search Terms:

- Dysphagia, Deglutition, Swallowing Disorders
- Biofeedback, Visual Biofeedback, Surface Electromyography (sEMG), Mechanomyography (MMG), Ultrasonography, Ultrasound

Inclusion Criteria:

- Inpatient
- Outpatient
- Cerebrovascular Accident (CVA)
- Head & Neck Cancer (HNC)
- Neurodegenerative
- TBI
- Age 19 or older.

Exclusion Criteria:

- Private Practice
- Non-peer reviewed journals
- Non-English Articles.

Appraisal Tool:

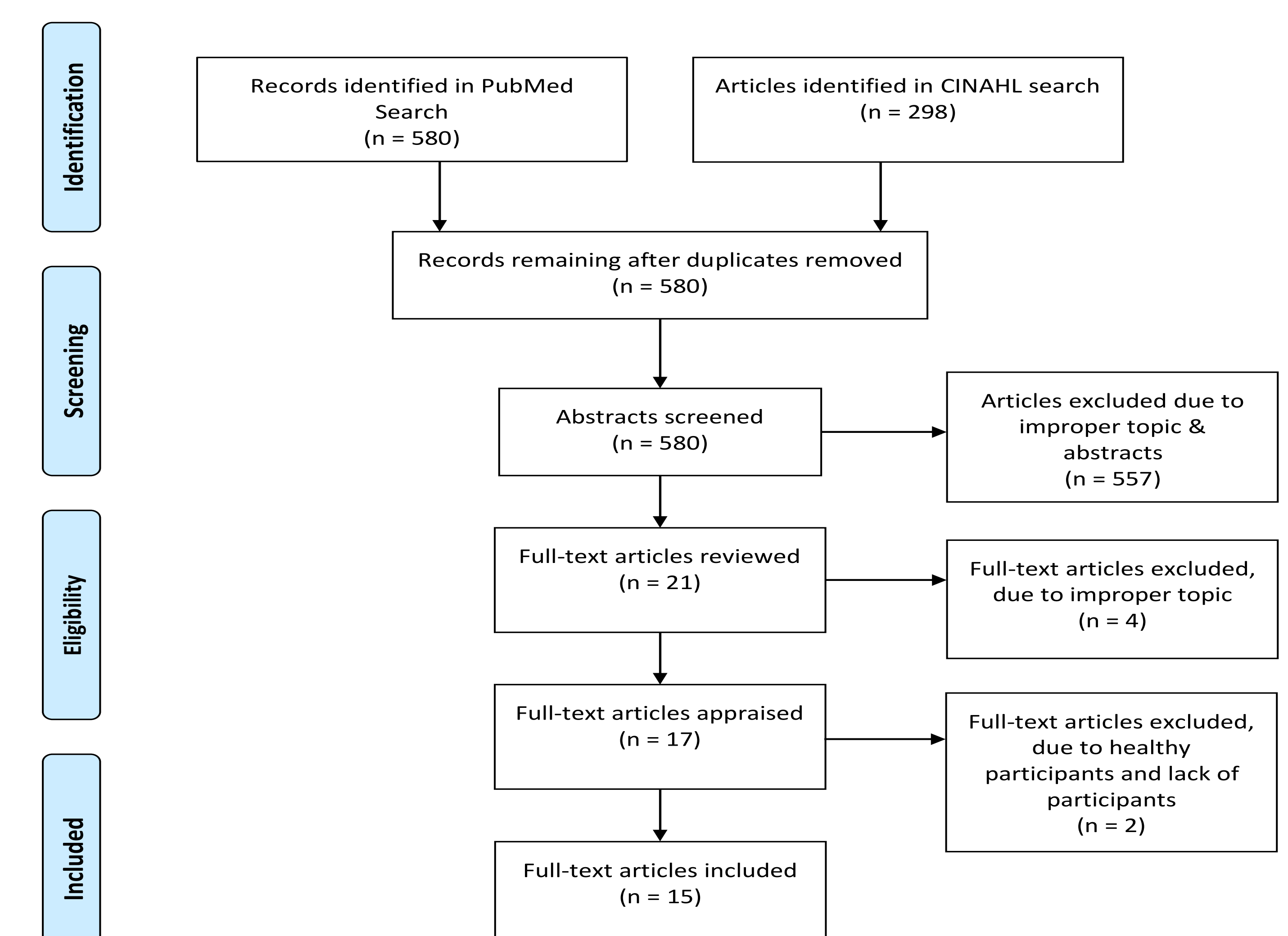
- The Joanna Briggs Institute Critical Appraisal Tool
- Intra-rater reliability was established at 95% on the quality appraisal reviews

Articles that Underwent Appraisal and Data Extraction

Author	Year	Study Design	Sample Size	Etiology of Dysphagia
Athukorala et al.	2014	Quasi-Experimental	10	Parkinson's Disease
Blyth et al.	2017	Case Report	2	Head & Neck Cancer
Bogaardt et al.	2009	Quasi-Experimental	11	Stroke
Carnaby-Mann et al.	2010	Case Control Study	24	Not Specified
Constantinescu et al.	2017	Quasi-Experimental	22 10	Healthy Adults Head & Neck Cancer
Crary et al.	2000	Text & Opinion	N/A	N/A
Crary et al.	2004	Quasi-Experimental	25 20	Stroke Head & Neck Cancer
Felix et al.	2008	Quasi-Experimental	4	Parkinson's Disease
Huckabee et al.	2014	Text & Opinion	N/A	N/A
Krishnan et al.	2013	Case Report	1	Parkinson's Disease
Li et al.	2016	Case Control Study	20	Stroke
Martin-Harris et al.	2015	Quasi-Experimental	30	Head & Neck Cancer
O'Rourke et al.	2017	Text & Opinion	1	Surgical Incident
Reddy et al.	2000	Case Report(s)	5	Stroke & Cancer
Tang et al.	2017	Quasi-Experimental	103	Alzheimer's Disease

Results

Author	Biofeedback	Results – Directly Quoted
Athukorala et al. (2014)	sEMG	"This skill-based training approach produced functional, biomechanical, and swallowing-related quality of life improvements" (Pg. 82).
Blyth et al. (2017)	Ultrasound	"This study establishes that ultrasound visual feedback is feasible in dysphagia rehabilitation following partial glossectomy" (Pg. 2215).
Bogaardt et al. (2009)	sEMG	"The use of sEMG as biofeedback in the treatment of chronic dysphagia after stroke is an effective adjunct to standard therapy for swallowing disorders" (Pg. 205).
Carnaby-Mann et al. (2010)	sEMG	"The McNeill Dysphagia Therapy Program resulted in superior outcomes compared with traditional dysphagia therapy supplemented with sEMG biofeedback" (Pg. 743).
Constantinescu et al. (2017)	sEMG & MMG	"Biofeedback provided as an adjuvant to dysphagia therapy in patients with HNC should employ sEMG technology, as this sensor type yielded better signal-to-noise ratio (SNR) and overall test-retest reliability" (Pg. 90).
Crary et al. (2000)	sEMG	"Clinical application of sEMG biofeedback techniques is relatively new to the area of dysphagia rehabilitation. It is still unknown who will benefit most or least from these techniques" (Pg. 124).
Crary et al. (2004)	sEMG	"Results indicated that this approach improved functional swallowing status in the majority of patients in both groups in a time-limited framework. These patients also experienced greater functional improvement, thus improving their cost-benefit outcome" (Pg. 164).
Felix et al. (2008)	Digital BF Manometer	"The effortful swallow maneuver reinforced by using biofeedback appears to be a therapeutic resource in the rehabilitation of oropharyngeal dysphagia in Parkinson's disease patients" (Pg. 226).
Huckabee et al. (2014)	sEMG	"Historically sEMG biofeedback has been used to facilitate mastery of effortful-type swallowing maneuvers. Recent research suggests great benefit of this modality for increasing skill and precision of movement using a targeted, skill-based rehabilitation protocol" (Pg. 50).
Krishnan et al. (2013)	Digital Accelerometry	"The client made consistent and rapid progress when compensatory strategies were used in combination with biofeedback therapy for hyolaryngeal excursion" (Pg. 98).
Li et al. (2016)	Game-Based BF	"Laryngeal elevation training combined with game-based biofeedback augments the change in hyoid bone displacement and FOIS scores, and increases the NG tube removal rate in patients with post-stroke dysphagia" (Pg. 773).
Martin-Harris et al. (2015)	Visual BF	"Improvements in respiratory-swallowing coordination can be trained using a systematic protocol and respiratory phase-lung volume-related biofeedback in patients with HNC and chronic dysphagia, with favorable effects on airway protection and bolus clearance" (Pg. 885).
O'Rourke et al. (2017)	High Resolution Pharyngeal Manometry	"HRPM biofeedback therapy is well tolerated, results in high patient satisfaction, and appears to improve accuracy of and adherence to home exercise programs" (Pg. 58).
Reddy et al. (2000)	Accelerometry	"The biofeedback therapy provides a dynamic, real-time, visual feedback for noninvasive quantitative measures of laryngeal elevation during swallowing" (Pg. 369).
Tang et al. (2017)	EMG	"Neuromuscular electrical stimulation and EMG-biofeedback treatment can improve swallowing function in patients with Alzheimer's Disease and significantly reduce the incidence of adverse outcomes" (Pg.1).



Clinical Implications

The effectiveness of biofeedback techniques alone or in conjunction with other swallowing therapy techniques may vary as a result of: patient motivation, cognition, etiology, and environmental factors such as family support. Biofeedback techniques are noninvasive, can be used in a variety of clinical settings, and can be used for the assessment or treatment of dysphagia. The limitations of biofeedback techniques include: instrumentation/user error, inappropriate patient positioning, and failure to consider patient factors such as anxiety or fatigue (Crary & Groher, 2000).

Discussion

Fourteen of the articles studied within this systematic review indicated that biofeedback techniques lead to improved therapy outcomes. However, due to small sample sizes and a lack of randomized controls, the reliability of these studies is questioned. One out of the 15 articles included in this systematic review determined that biofeedback was not an effective treatment for patients with dysphagia. This systematic review revealed that randomized control studies are necessary to determine the efficiency and efficacy of biofeedback techniques in the treatment of adults with dysphagia. These studies should have defined treatment protocols (biofeedback alone or in conjunction with), representative sample sizes, blinding, defined etiology, and patient follow-up measures. Further research is also needed to determine differences in outcomes across etiologies and the various biofeedback techniques.

References

References are available upon request.

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