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Systematic Review

Physiotherapy interventions for stroke-related dysphagia - a systematic review

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ABSTRACT

Dysphagia, or difficulty in swallowing, affects over half of stroke survivors, leading to severe complications such as aspiration pneumonia, malnutrition, and dehydration. Physiotherapy interventions, including swallowing exercises, neuromuscular electrical stimulation (NMES), respiratory muscle training, and compensatory strategies, show potential in improving swallowing function. This systematic review consolidates the evidence on the effectiveness of physiotherapy interventions in stroke-related dysphagia. A systematic review was conducted using preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines. Articles were retrieved from databases such as PubMed and Google Scholar. The review analyzed various physiotherapy interventions and their impact on swallowing function and aspiration risk. Results indicate that interventions such as chin tuck against resistance (CTAR), NMES, and respiratory muscle training significantly improve swallowing safety and function. A combination of multiple strategies yielded better results than single interventions. This study highlights the importance of individualized physiotherapy management in stroke-related dysphagia rehabilitation.

Keywords: Stroke, Dysphagia, Physiotherapy interventions, Respiratory muscle training

INTRODUCTION

Dysphagia is the inability to swallow.[1] While it is categorized in International Classification of Diseases-10 (ICD-10) under "symptoms and signs," in certain situations it is categorized as a separate illness. This sensation could manifest as a challenge in smoothly moving solids or liquids down the throat and into the stomach possibly due to decreased pharyngeal sensation or other deficiencies within the swallowing mechanism.[2] Swallowing is regulated by multiple brain regions, including the brainstem, basal ganglia, thalamus, limbic system, cerebellum, and motor and sensory cortices. These areas coordinate afferent and efferent pathways, as well as anticipatory, preparatory, voluntary, and automatic functions. The process involves over 30 muscles, controlled by a complex neural network that remains only partially understood. The central pattern generator (CPG) for swallowing is primarily located in the rostral and ventrolateral medulla, encompassing the nucleus tractus solitarius (NTS), reticular formation, and nucleus ambiguus (NA).[3,4] The interneuronal network governs the sequencing of swallowing phases and integrates sensory inputs and supramedullary signals with motor outputs.[3] Sensory signals from mechanoreceptors, chemoreceptors, and thermoreceptors in the oral cavity, pharynx, and larynx influence the CPG, playing a role in initiating swallowing, enhancing its process, and ensuring airway protection.[5,6] Sensory neurons from the oral cavity connect to the trigeminal sensory nuclei, while those from the pharynx and larynx travel via branches of cranial nerves IX, X, and XI to synapse in the NTS.[7]

There are four stages involved in swallowing: pre-oral, oral, pharyngeal, and oesophageal.[8]

Pre-oral phase

This initial stage involves transferring food from the plate to the mouth.

Oral phase

This stage is voluntary and includes the intake of food into the oral cavity, along with its preparation for swallowing.

Pharyngeal phase

Initiated by the tongue's propulsion of the bolus backward, this phase triggers reflexive actions. The base of the tongue contacts the posterior pharyngeal wall, prompting the elevation of the soft palate to prevent nasal reflux. Contraction of the pharyngeal constrictor muscles pushes the bolus through the pharynx. The epiglottis flips to cover the larynx, and the vocal folds close to prevent aspiration.

Oesophageal phase

This phase is entirely involuntary and involves peristaltic waves that propel the bolus through the esophagus.

Dysphagia is broadly categorized into several primary types, each with distinct characteristics. Oropharyngeal dysphagia involves difficulty in the initial stages of swallowing, often due to neuromuscular disorders affecting the oropharynx. Esophageal and obstructive dysphagia result from structural abnormalities or blockages within the esophagus that hinder the passage of food. Neuromuscular symptom complexes contribute to swallowing difficulties through conditions affecting muscle coordination and function. Additionally, functional dysphagia is observed in certain patients who experience swallowing difficulties despite the absence of an identifiable organic cause. These classifications help in understanding the underlying mechanisms and guiding appropriate management strategies.[9]

Within the Indian population, the frequency of stroke is thought to fall within the range of 116 to 163 cases per 100,000 individuals.[9] A recent publication from the Indian Council of Medical Research (ICMR) titled 'India: Health of the nation's states' indicates that stroke ranks as the fourth primary cause of mortality and the fifth principal cause of disability-adjusted life years (DALY) in India.[10]

Dysphagia therapy includes compensatory and rehabilitative approaches. Compensatory strategies ensure safe eating, while rehabilitative methods, like swallowing training, aid recovery. Patients often start with compensatory techniques before transitioning to rehabilitation. Functional swallowing therapy, led by speech-language pathologists, aims to restore normal swallowing and prevent complications like pneumonia and malnutrition. Supportive treatments such as thermal tactile stimulation, transcranial magnetic stimulation, and transcranial direct current stimulation may also enhance recovery.[11]

Compensatory treatment procedures aim to alter the passage of food and liquids and alleviate symptoms without directly affecting the physiology of swallowing. These include postural techniques, alterations in food consistency (diet), adjustments in volume and speed of food presentation, techniques to enhance oral sensory awareness, and the utilization of intraoral prosthetics. In addition to these, physiotherapy treatment procedures are designed to modify and enhance swallowing function. These involve exercises to improve oral and pharyngeal range of motion, resistance exercises to strengthen swallowing muscles, and exercises that focus on controlling bolus movement during swallowing. Various swallowing maneuvers, such as the supraglottic swallow, super-supraglottic swallow, effortful swallow, and Mendelsohn maneuver, are also employed to facilitate safe and efficient swallowing.[12]

Physiotherapy interventions play a crucial role in managing post-stroke dysphagia by enhancing swallowing function and preventing complications like aspiration pneumonia. Neuromuscular electrical stimulation (NMES) has been shown to improve swallowing when combined with traditional therapy by stimulating the muscles involved in deglutition.[13]

Transcranial direct current stimulation (tDCS), a non-invasive brain stimulation technique, has also demonstrated benefits in modulating neuronal activity to support swallowing recovery.[14]Early initiation of swallowing therapy is associated with better outcomes, as patients who start therapy sooner show significant functional improvements and reduced risk of pneumonia.[15] Additionally, traditional swallowing exercises remain fundamental, though research highlights the need for standardized reporting of exercise dosage to optimize their efficacy.[16]

Overall, physiotherapy can be a valuable adjunct to medical management in patients with dysphagia. It can aid in improving swallowing function, reducing aspiration risk, alleviating discomfort, preventing complications, and enhancing oral mobility and function. However, the specific techniques utilized will vary based on each patient's unique condition and the underlying causes of their dysphagia

Objective

Objective was to study the various physiotherapy interventions for managing stroke-related dysphagia.

METHODS

Study design

The study was a systematic review.

Data extraction

Articles from eligible search engine including PUBMED and Google scholar using key words such as "stroke", "dysphagia", "physiotherapy interventions", and "respiratory muscle training".

Duration of study

The duration of the study was from August 2024 to February 2025.

Study place

The study was conducted at Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences.

Sample size

The sample size included 20 articles.

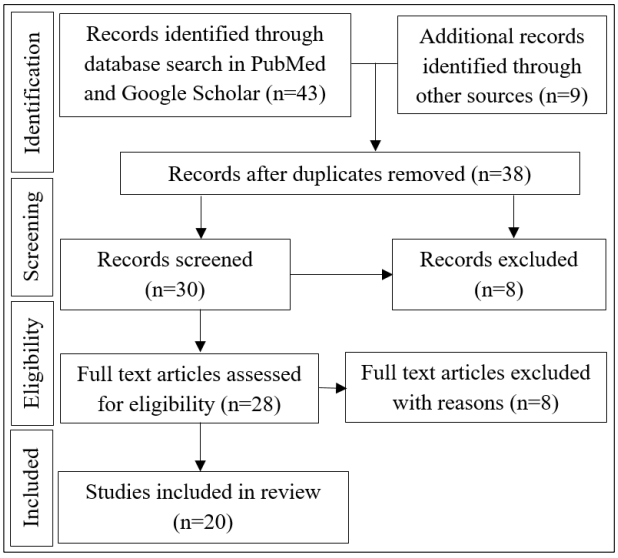

Figure 1: Flowchart of PRISMA.

We followed preferred reporting-items for systematic reviews and meta-analyses (PRISMA) scale, PRISMA standards for systematic reviews and meta-analyses in its design and reporting on how the study was carried out. We searched articles using search engines PubMed, google scholar using key words as "stroke", "dysphagia", "physiotherapy interventions", and "respiratory physiotherapy". The articles were searched according to the inclusion and exclusion criteria of the study.

Selection criteria

The selection criteria for this study include both inclusion and exclusion parameters. The inclusion criteria consist of full-text articles, studies published in the last 13 years, and research designs such as cross-sectional studies, observational studies, systematic reviews, case studies, randomized controlled trials, and meta-analyses. The exclusion criteria include duplicate articles, articles with only abstracts, and those published in languages other than English.

RESULTS

The review above of 20 studies presents the results of various dysphagia interventions, summarized as follows.

Chin tuck against resistance exercise improved swallowing function and suprahyoid muscle activation better than the shaker exercise. [17]

Expiratory muscle strength training significantly enhanced muscle activity, reduced aspiration, and improved oral intake, while the placebo group showed no significant changes.[18]

Respiratory muscle training using a Dofin breathing trainer improved respiratory function, fatigue levels, voice quality, and swallowing, with no adverse effects.[19]

Neuromuscular electrical stimulation combined with swallowing exercises led to greater swallowing improvements, with 75 percent of patients improving versus 57 percent in the usual care group.[20]

Tongue-pressure training increased tongue strength by approximately 20 kilopascals but did not significantly impact swallowing safety or stage transition duration.[21]

Cervical isometric exercises improved cervical spine alignment and swallowing function more than balance training. [22]

Effortful swallowing training significantly enhanced anterior and posterior tongue strength.[23]

Transcranial direct current stimulation combined with conventional dysphagia therapy improved swallowing function, reduced aspiration risk, and enhanced hyoid movement.[24]

Head lift exercises improved hyoid displacement and reduced aspiration risk more than conventional therapy alone.[25]

Tongue-to-palate resistance training significantly improved tongue strength and oropharyngeal swallowing function.[26]

Modified chin tuck against resistance exercise led to better swallowing improvements than traditional dysphagia therapy alone.[27]

Respiratory muscle training reduced respiratory complications and improved swallowing safety.[28]

Functional electrical stimulation combined with speech therapy improved swallowing, but functional electrical

stimulation showed no additional benefit beyond conventional therapy.[29]

Neuromuscular electrical stimulation improved swallowing in 10 out of 11 studies, especially when combined with conventional therapy.[13]

Inspiratory and expiratory muscle training and neuromuscular electrical stimulation improved swallowing safety, but effects diminished by three months.[30]

Electrical pharyngeal stimulation enabled successful decannulation in 75 percent of patients versus 20 percent in the sham group.[31]

Shaker exercise combined with conventional dysphagia therapy significantly reduced aspiration and improved oral diet levels.[32]

Sensory-level electrical stimulation improved swallowing function, reduced dysphagia severity, and was well tolerated.[33]

Surface neuromuscular electrical stimulation combined with dysphagia therapy significantly improved swallowing, with better hyoid movement in one treatment group.[34]

Game-based chin tuck against resistance versus head lift exercise both improved swallowing function, but the chin tuck against resistance group had higher motivation and lower dropout rates.[35]

Table 1: The review above of 20 studies.

Title of article	Authors	Treatment strategies	Results
Chin tuck against resistance exercise for dysphagia rehabilitation: a systematic review[17]	Park et al	The chin tuck against resistance (CTAR) exercise involving strengthening the suprahyoid muscles using tools like elastic rubber balls, resistance bars, or therabands.	Chin tuck against resistance exercises significantly improved swallowing function and safety in patients with dysphagia by activating suprahyoid muscles more effectively than shaker.
Effects of expiratory muscle strength training on oropharyngeal dysphagia in subacute stroke patients: a randomised controlled trial[18]	Park et al	Experimental group: expiratory muscle strength training (forced exhalations through a resistance-adjustable device). Placebo group: sham device with no resistance.	Experimental group: significant improvement in suprahyoid muscle activity, reduced aspiration and improved oral intake. Placebo group: no significant improvement in muscle activity; modest improvement in semisolid PAS scores.
Respiratory muscle training in stroke patients with respiratory muscle weakness, dysphagia, and dysarthria – a prospective randomized trial[19]	Liaw et al	Inspiratory and expiratory respiratory muscle training: using a dofin breathing trainer. Regular rehabilitation: including postural training, breathing control, swallowing exercises, and other supportive therapies.	The respiratory muscle training group showed significant improvements in MIP, FVC, FEV1, fatigue levels, voice quality, and swallowing function (FOIS) compared to the control group. No significant differences were found in the control group, and no adverse events were reported.
Combined electrical stimulation and exercise for swallow rehabilitation post-stroke: a pilot randomized control trial[20]	Sproson et al	Ampcare ESP group: neuromuscular electrical stimulation (nMES) + swallow-strengthening exercises for suprahyoid muscles. Control group (usual care):standard speech and language therapy, postural adaptations, diet modifications.	The intervention group (Ampcare ESP) showed greater improvements in swallowing function, with 75% of patients improving on the FOIS, compared to 57% in the usual care group.
A randomized trial comparing two tongue-pressure resistance training protocols for post-stroke dysphagia[21]	Steele et al	Tongue-pressure profile training (TPPT): control of posterior tongue pressure release during swallowing tasks. Tongue-pressure strength and accuracy training (TPSAT): strength and accuracy training without swallowing tasks.	Both the strategies significantly improved tongue strength, with an average increase of 20 kPa. There were no significant improvements in stage transition duration or swallowing safety.

Continued.

Title of article	Authors	Treatment strategies	Results
Cervical isometric exercises improve dysphagia and cervical spine malalignment following stroke with hemiparesis: a randomized controlled trial[22]	Ploumis et al	Standard therapy: swallowing muscle strengthening, compensatory techniques, physiotherapy, occupational therapy, speech-language therapy. Cervical isometric exercises: static resistance exercises (flexion, extension, lateral flexion, rotation). Sitting balance exercises: balance training without targeted cervical exercises.	The study found that patients in the experimental group, who performed cervical isometric exercises alongside standard therapy, showed significantly greater improvement in cervical spine alignment (C2-C7 Cobb angle) and swallowing function compared to the control group.
Effect of effortful swallowing training on tongue strength and oropharyngeal swallowing function in stroke patients with dysphagia: a double-blind, randomized controlled trial[23]	Park et al	Experimental group: effortful swallowing training. Control group: natural saliva swallowing (no intentional effort). Conventional dysphagia therapy: compensatory techniques, orofacial muscle exercises, thermal tactile stimulation.	The experimental group showed significant improvement in anterior and posterior tongue strength compared to the control group.
Transcranial direct current stimulation for post-stroke dysphagia: a meta-analysis[24]	Gómez-García et al	Transcranial direct current stimulation (tDCS): Unilateral or bilateral application. Conventional dysphagia therapy: dietary modifications, postural adjustments, swallowing maneuvers, physical therapy exercises. Combined approaches: tDCS with balloon dilatation or neuromuscular electrical stimulation.	The study found that transcranial direct current stimulation combined with conventional dysphagia therapy significantly improved swallowing function, reduced penetration and aspiration risks, and enhanced hyoid movement and cortico-motor activation.
Effect of head lift exercise on kinematic motion of the hyolaryngeal complex and aspiration in patients with dysphagic stroke[25]	Park et al	The study used head lift exercise with combined with conventional dysphagia therapy which included orofacial muscle exercises, thermal tactile stimulation, and swallowing maneuvers.	Head lift exercise (HLE) significantly improved vertical hyoid displacement and reduced aspiration risk, outperforming conventional therapy alone in dysphagic stroke patients.
Tongue to palate resistance training improves tongue strength and oropharyngeal swallowing function in subacute stroke survivors with dysphagia[26]	Kim et al	Tongue to palate resistance training (TPRT) + traditional dysphagia therapy. Traditional dysphagia therapy: thermal tactile stimulation, facial massage.	The experimental group demonstrated significant improvements in tongue strength and swallowing function in the oral and pharyngeal phases.
Efficacy of modified chin tuck against resistance exercise using hand-free device for dysphagia in stroke survivors: a randomized controlled trial[27]	Kim et al	Modified chin tuck against resistance (mCTAR): isometric (holding chin down against resistance) and isotonic (repeated chin-down movements) exercises using PhagiaFLEX-HF. Traditional dysphagia treatment (TDT): oral facial massage, thermal-tactile stimulation, compensatory strategies.	The experimental group, which performed mCTAR exercises along with traditional dysphagia treatment (TDT), demonstrated greater improvements compared to the control group that received only TDT.
Respiratory muscle training reduces respiratory complications and improves swallowing function after stroke: a systematic review and meta-analysis[28]	Zhang et al	The treatment involves respiratory muscle training (RMT) using devices like threshold resistance trainers or flow-oriented trainers.	The study found that respiratory muscle training effectively reduces respiratory complications, such as pneumonia and lung infections, and improves swallowing function by making it safer.
Combined conventional speech therapy and functional electrical stimulation in acute	Matos et al	Functional electrical stimulation (FES): suprahyoid and thyroid regions. Conventional speech	The study found that both treatment groups showed improvements in swallowing

Continued.

Title of article	Authors	Treatment strategies	Results
stroke patients with dysphagia: a randomized controlled trial[29]		therapy: isotonic and isometric exercises, swallowing reflex stimulation, swallowing maneuvers. Control group: inactive FES + conventional therapy.	function, with no significant difference between them. Both groups had a tendency to improve swallowing and reduce dysphagia, but FES did not offer additional benefits beyond conventional therapy.
Effectiveness of neuromuscular electrical stimulation on post-stroke dysphagia: a systematic review of randomized controlled trials[13]	Alamer et al	Neuromuscular electrical stimulation (NMES): oropharyngeal muscles. Conventional swallowing therapies: lingual-strengthening exercises, effortful swallowing, laryngeal adduction-elevation exercises, postural adjustments.	The review found that NMES improved swallowing function in post-stroke dysphagia patients in 10 out of 11 studies, showing significant improvements in swallowing ability and safety. One study, however, reported no significant difference between NMES and control groups. NMES combined with conventional therapy was more effective than conventional therapy alone.
Respiratory muscle strength training and neuromuscular electrical stimulation in subacute dysphagic stroke patients: a randomized controlled trial[30]	Guillén-Solà et al	Standard swallow therapy: education, oral exercises, compensatory techniques. Inspiratory and expiratory muscle training (IEMT) respiratory muscle training for inspiratory and expiratory muscles. Neuromuscular electrical stimulation (NMES): electrical stimulation of suprahyoid muscles during swallowing.	IEMT and NMES improved swallowing security signs, with IEMT enhancing respiratory muscle strength, but effects diminished by three months. No long-term differences in swallowing outcomes or respiratory complications were observed across groups.
Electrical pharyngeal stimulation for dysphagia treatment in tracheotomized stroke patients: a randomized controlled trial[31]	Suntrup et al	Treatment group: electrical pharyngeal stimulation (Phagenyx™ system via nasogastric tube, intensity based on perceptual and maximum tolerated thresholds). Sham group: catheter placement without current flow.	Results show that, electrical pharyngeal stimulation (EPS) enabled successful decannulation in 75% of treated patients versus 20% in the sham group ($p<0.01$), with no adverse events reported. EPS significantly improved swallowing function and airway protection in severely dysphagic, tracheotomized stroke patients.
Effects of shaker exercise in stroke survivors with oropharyngeal dysphagia[32]	Choi et al	Experimental: shaker exercise + conventional dysphagia therapy (orofacial muscle exercises, thermal tactile stimulation, therapeutic maneuvers, compensatory techniques). Control: conventional dysphagia therapy only.	Participants in the experimental group experienced greater reductions in aspiration and better improvements in oral diet levels compared to the control group.
The effect of sensory level electrical stimulation of the masseter muscle in early stroke patients with dysphagia: a randomized controlled study[33]	Umay et al	Sensory-level electrical stimulation (SES): bilateral masseter muscles. Traditional swallowing therapy: oral hygiene, thermal and tactile stimulation, swallowing maneuvers, dietary modifications, oral motor exercises.	The study found that sensory-level electrical stimulation (SES) significantly improved swallowing function, reduced dysphagia severity, and enhanced cognitive and overall functional abilities in early stroke patients. No significant improvements were observed in the control group, and SES was

Continued.

Title of article	Authors	Treatment strategies	Results
			well-tolerated without adverse effects.
The effect of surface neuromuscular electrical stimulation on patients with post-stroke dysphagia[34]	Meng et al	Group A: surface neuromuscular electrical stimulation (suprahyoid and thyroid cartilage) + dysphagia therapy (shaker exercise, effortful swallow, Masako maneuver, supraglottic swallow, Mendelsohn maneuver, diet modifications). Group B: surface neuromuscular electrical stimulation (geniohyoid and mylohyoid) + dysphagia therapy. Control: dysphagia therapy only.	The results showed significant improvements in swallowing function for both treatment group A and treatment group B compared to the control group. Both treatment groups demonstrated better post-treatment outcomes, with treatment group B showing a significant improvement in the anterior movement of the hyoid bone. There was no significant difference between the two treatment groups, but both were more effective than the control group.
Effects of game-based chin tuck against resistance exercise vs head-lift exercise in patients with dysphagia after stroke: an assessor-blind, randomized controlled trial.[35]	Park et al	Experimental: game-based chin tuck against resistance (laryngeal elevation system, 70% one-repetition maximum, isometric and isotonic). Control: head-lift exercise (supine, isometric and isotonic). Both: dysphagia therapy (oral facial massage, thermal-tactile stimulation, compensatory training).	Both groups showed significant improvements in swallowing function, with no difference in effectiveness. The experimental group reported higher motivation, enjoyment, and less fatigue, with no dropouts, while the control group had four dropouts due to discomfort.

DISCUSSION

Park et al carried out a systematic review evaluating the effectiveness of the CTAR exercise in improving suprahyoid muscle strength and swallowing function. Their findings suggested that this technique offers greater benefits compared to the shaker exercise in enhancing swallowing safety and efficiency.[17]

Park et al designed a randomized controlled trial to assess the impact of expiratory muscle strength training in subacute stroke patients. The results highlighted significant improvements in suprahyoid muscle activity, a reduction in aspiration risk, and better oral intake outcomes within the intervention group.[18]

Liaw et al explored the effects of respiratory muscle training using the Dofin breathing trainer in stroke patients with dysphagia through a randomized controlled trial. The study demonstrated notable enhancements in pulmonary function, reduced fatigue, and improved swallowing function.[19]

Sproson et al investigated the role of neuromuscular electrical stimulation using the Ampcare effective swallowing protocol alongside traditional swallow-strengthening exercises. Their randomized controlled trial revealed that the combination therapy led to more substantial improvements in swallowing function compared to conventional therapy alone.[20]

Steele et al examined different tongue-pressure resistance training protocols in individuals with post-stroke dysphagia through a randomized controlled trial. Both high- and low-intensity training approaches were found to enhance tongue strength and swallowing ability.[21]

Ploumis et al assessed the impact of cervical isometric exercises on swallowing function in stroke patients with hemiparesis. Their findings indicated improvements in cervical spine alignment and swallowing function, emphasizing the potential role of cervical exercises in dysphagia rehabilitation.[22]

Park et al evaluated the effectiveness of effortful swallowing training in patients with oropharyngeal dysphagia. Their randomized controlled trial demonstrated significant improvements in tongue strength and swallowing function, reinforcing the value of this intervention.[23]

Gómez-García et al reviewed existing literature on transcranial direct current stimulation in dysphagia rehabilitation through a meta-analysis. The results suggested that combining this technique with conventional therapy enhances swallowing function, increases hyoid movement, and improves cortico-motor activation.[24]

Park et al analyzed the effects of head lift exercises in dysphagic stroke patients. Their randomized controlled trial found that individuals practicing these exercises

showed improved hyoid displacement and a reduced risk of aspiration.[25]

Kim et al focused on tongue-to-palate resistance training in individuals with dysphagia. The study highlighted significant enhancements in tongue strength and swallowing function compared to traditional dysphagia therapy alone.[26]

Kim et al studied a modified version of the CTAR exercise in a randomized controlled trial. The modified technique yielded greater improvements in swallowing function and feeding independence compared to standard therapy.[27]

Zhang et al synthesized findings from multiple studies on respiratory muscle training in dysphagia management through a systematic review and meta-analysis. Their conclusions pointed to its effectiveness in reducing respiratory complications and improving swallowing safety.[28]

Matos et al explored the role of functional electrical stimulation in dysphagia rehabilitation. While their randomized controlled trial showed improvements across both intervention and control groups, the findings suggested that electrical stimulation did not offer significant additional benefits over speech therapy alone.[29]

Alamer et al reviewed randomized controlled trials assessing neuromuscular electrical stimulation in swallowing function. Their systematic review concluded that when combined with conventional therapy, this technique enhances swallowing function and safety in dysphagic individuals.[13]

Guillén-Solà et al in their randomized controlled trial investigated respiratory muscle strength training and neuromuscular electrical stimulation in dysphagic stroke patients. Both therapies improved swallowing security, with respiratory muscle training enhancing strength, though effects declined after three months. No long-term differences were observed.[30]

Suntrup et al examined the use of electrical pharyngeal stimulation in tracheotomized stroke patients with dysphagia. Their randomized controlled trial demonstrated significant improvements in swallowing function and an increased rate of successful decannulation.[31]

Choi et al investigated the effects of the shaker exercise in stroke patients with dysphagia. Their trial found reductions in aspiration and improvements in oral diet levels among participants performing the exercise compared to those receiving conventional therapy alone.[32]

Umay et al assessed the impact of sensory-level electrical stimulation applied to the masseter muscles in dysphagia patients. Their findings revealed significant improvements in swallowing function and cognitive abilities, suggesting potential benefits beyond motor rehabilitation.[33]

Meng et al examined surface neuromuscular electrical stimulation as a dysphagia rehabilitation method. The study demonstrated notable enhancements in swallowing function, with one experimental group showing greater anterior hyoid movement, supporting the efficacy of this intervention.[34]

Park et al compared different dysphagia rehabilitation approaches in a randomized controlled trial, highlighting distinct advantages of each technique in improving swallowing safety and efficiency.[35]

So, based on the analysis of 20 articles, this review highlights a range of interventions for managing post-stroke dysphagia. Techniques such as CTAR exercise, expiratory and respiratory muscle strength training, neuromuscular electrical stimulation, tongue-pressure resistance training, cervical isometric exercises, effortful swallowing training, transcranial direct current stimulation, head lift exercises, and functional electrical stimulation paired with speech therapy were evaluated. These methods demonstrated significant potential in improving swallowing function, emphasizing the importance of individualized therapeutic approaches.

CONCLUSION

Physiotherapy interventions have a significant impact on the management of post-stroke dysphagia by enhancing swallowing function, improving airway protection, and reducing aspiration risk. These evidence-based approaches, including resistance exercises, electrical stimulation, respiratory muscle training, and motor control strategies, contribute to better rehabilitation outcomes and functional recovery in stroke-related dysphagia.

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