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Application of Evidence-Based Nursing Practice: Shaker Exercise for Swallowing Ability in Stroke Patients with Dysphagia

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Abstract

Background: Stroke is one of the leading causes of disability and mortality worldwide, with more than 13 million new cases recorded annually. Stroke can lead to various complications, including dysphagia, which disrupts the patient's swallowing ability. One therapy that can assist stroke patients with dysphagia is the Shaker Exercise.
Objectives: This study aims to provide an overview of the impact of implementing Shaker Exercise on swallowing ability in stroke patients experiencing dysphagia through Evidence-Based Nursing Practice (EBNP).
Methods: The study used a systematic approach by reviewing various articles and literature from seven prominent health databases, including ProQuest, PubMed, and ScienceDirect. Selected articles focused on Shaker Exercise interventions for stroke patients with dysphagia.
Results: The review identified one article in the form of a Systematic Review Meta-Analysis, which examined 37 studies involving a total of 2,656 participants. The analysis results demonstrated that the Shaker Exercise is effective in strengthening suprahyoid muscles, reducing aspiration frequency, and improving swallowing ability in stroke patients with dysphagia.
Conclusion: The implementation of Shaker Exercise therapy for stroke patients with dysphagia shows significant results in enhancing swallowing ability and reducing aspiration complications. This therapy aligns with evidence-based nursing principles, supporting the improvement of patients' quality of life through scientifically proven interventions.

Keywords: dysphagia, evidence-based nursing, shaker exercise, stroke, swallowing ability

Introduction

Stroke is among the leading causes of disability and mortality worldwide. According to the World Stroke Organization, over 13 million new cases of stroke are recorded annually. The absolute number of individuals affected by stroke-whether through its onset, death, or lasting disability-has risen from 1990 to 2016.[1] According to the latest data from the World Stroke Organization (2022), stroke remains the second leading cause of death and the third leading cause of combined death and disability globally. It is estimated that the global cost of stroke exceeds US$721 billion, or about 0.66% of the world's Gross Domestic Product (GDP). Globally, there are more than 101 million people currently living after having a stroke. Of these, 22% are individuals aged 15-49 years, and 67% are under the age of 70.[2] Other data indicate that mortality and disability rates have doubled since the 1990s, according to the World Stroke Organization (WSO).[1] Another significant impact of stroke is the loss of independence and a decline in quality of life. While previous care for stroke patients primarily focused on the acute phase, recent studies show that a substantial group of post-stroke patients have experienced persistent disability for years.[3] Additionally, the high prevalence of stroke remains a global concern as efforts continue to address the associated challenges.[4] Stroke cases are projected to increase to 642 million by 2040, with approximately 75% of stroke patients experiencing varying degrees of physical and mental health issues, including depression, which affects 20% to 60% of stroke patients.[5]

This growing prevalence has made stroke a global concern, not only burdening families but also placing significant strain on nations. In Europe, it is recorded that a stroke-related death occurs every four seconds out of a total of 65,000 cases. In developing countries, 30% to 70% of individuals are diagnosed with either hemorrhagic or non-hemorrhagic stroke.[6] In Indonesia, the stroke prevalence is approximately 10.9% among individuals aged 15 and older. Of this population, only 39.4% undergo follow-up examinations at healthcare facilities. In East Kalimantan, 14.7% of individuals aged 15 and above have been diagnosed with stroke, with just 33.1% seeking follow-up care.[7]

The impact of stroke varies depending on the damaged area of the brain. According to the American Stroke Association (ASA), swallowing difficulties occur in approximately 65% of stroke patients. These difficulties result from impaired muscle coordination, weakened muscle tone, or damage to the brain hemispheres, cranial nerve fibers, or the muscles responsible for chewing and swallowing. Stroke patients with swallowing difficulties may experience aspiration, where food or liquids enter the respiratory tract, or, in severe cases, malnutrition and dehydration.[8] A decline in swallowing ability can be life-threatening. Dysphagia may lead to complications such as aspiration, pneumonia, dehydration, malnutrition, and even death.[8] During the oral phase, aspiration typically triggers severe coughing. However, in stroke patients, the loss of this reflex can pose significant risks to life. To prevent complications from dysphagia, swallowing rehabilitation is essential for stroke patients. Rehabilitation should focus on strengthening the hyoid muscles. One effective exercise to strengthen the suprahyoid muscles and improve swallowing muscle stimulation is the Shaker Exercise.[9]

The Shaker Exercise is a remedial or repetitive training method involving head-lifting exercises to strengthen the muscles associated with swallowing, located in the front of the neck. This exercise focuses on isometric and isokinetic contraction movements, performed by lying down and lifting the head while keeping the eyes fixed on the toes. Previous research by Easterling has shown that the Shaker Exercise is effective in activating the suprahyoid muscles, including the digastric, geniohyoid, and mylohyoid muscles located in the front of the neck. Additionally, the Shaker Exercise enhances the anterior and superior movement of the hyoid bone and contributes to the opening of the upper esophageal sphincter, thereby facilitating the swallowing process and promoting food passage to the lower digestive system.[10]

Based on the explanation above, it becomes a crucial reason for the residency program to implement nursing interventions rooted in Evidence-Based Nursing Practice

(EBNP) to address nursing problems in stroke patients with swallowing disorders. Providing the Shaker Exercise intervention is seen as a practical approach to managing dysphagia in stroke patients.

Methods

The researchers used seven databases commonly utilized for retrieving articles in the health field. For national articles, Garuda (Garba Rujukan Digital) from the Ministry of Education and Culture and Google Scholar were employed. For international articles, the researchers conducted searches in PubMed, ScienceDirect, EBSCO, J-STOR, and ProQuest. The initial search using these databases resulted in articles focusing on the application of the Shaker Exercise to improve swallowing ability in stroke patients with dysphagia. From the search results, one article met the inclusion criteria: a Systematic Review and Meta-Analysis study authored by Speyer, R.; Cordier, R.; Sutt, A.-L.; Remijn, L.; Heijnen, B.J.; Balaguer, M.; Pommée, T.; McInerney, M.; and Bergström, L. (2022), titled Behavioural Interventions in People with Oropharyngeal Dysphagia: A Systematic Review and Meta-Analysis of Randomised Clinical Trials. This article reviewed 37 studies involving a total of 2,656 participants. The inclusion criteria for respondents in this study were Ischemic Stroke Patients, Positive Dysphagia, Stroke Patients with full consciousness (GCS 14-15), Agreeing to participate in the implementation of EBN as evidenced by informed consent, Stable hemodynamics with TTV indicators (BP, RR, S, N) within normal limits.

The article was published in the journal Clinical Medicine, which is ranked Q2 in the Journal Citation Reports (JCR) for Medicine, General & Internal, and Q1 in CiteScore for General Medicine. The inclusion criteria for the literature reviewed in this article were as follows: (1) patients with oropharyngeal dysphagia (OD); (2) behavioral interventions aimed at reducing swallowing or eating difficulties; (3) studies including a comparison group; (4) participants randomly assigned to one of the study groups; and (5) studies published in English. The risk of bias for the included RCTs was assessed using the RoB 2 tool. The summary of the risk of bias per domain was evaluated for individual studies and all included studies. Most studies demonstrated a low risk of bias in individual domains; however, more than half of the included studies (19 out of 37) were overall rated as having some concerns, with three studies identified as having a high risk of bias. All study groups were categorized into compensatory interventions, rehabilitative interventions, and combined compensatory and rehabilitative interventions. Seventeen studies were excluded from the meta-analysis: one study included patients with self-reported swallowing difficulties without a confirmed diagnosis of OD through instrumental assessments (VFSS or FEES), four studies did not report instrumental or non-instrumental clinical outcome data, ten studies provided insufficient data for meta-analysis, and two studies were excluded to reduce heterogeneity between studies.

Overall, in the group analysis, a large and significant pre- and post-intervention effect size was calculated using a random-effects model ($z(35) = 8.047$, $p < 0.001$, Hedges' $g = 1.139$, and 95% CI = 0.862–1.416). The pre-and post-intervention effect sizes varied widely across studies, ranging from 0.058 to 5.732. Of the 36 intervention groups included in the meta-analysis, 19 groups demonstrated large effect sizes (Hedges' $g > 0.8$), six groups showed medium effect sizes ($0.5 <$ Hedges' $g \leq 0.8$), seven groups showed small effect sizes ($0.2 <$ Hedges' $g \leq 0.5$), and four groups showed negligible effect sizes (Hedges' $g \leq 0.2$). The heterogeneity among studies was significant ($p < 0.001$). A subgroup analysis was conducted to compare various types of interventions: behavioral interventions versus conventional dysphagia therapy (CDT) or groups without dysphagia therapy. Both behavioral interventions and CDT were categorized into compensatory interventions, rehabilitative interventions, and combined compensatory and rehabilitative interventions. Overall, significant treatment effects were identified in favor of behavioral interventions. Notably, large effect sizes were observed when comparing rehabilitative interventions without CDT and combined interventions with compensatory CDT.

When comparing selected interventions based on similarities across studies to CDT, significant and large effect sizes were found in favor of the Shaker Exercise, chin tuck against resistance (CTAR), and expiratory muscle strength training (EMST). Most studies were conducted on stroke populations and showed moderate to significant effect sizes. This data analysis employed a bivariate analysis method, which examines the relationship or correlation between two variables.[11] The statistical analysis method used was ANOVA Repeated Measures. The hypothesis testing was conducted using Jamovi software, with a significance level of $\alpha = 5\%$ (0.05). The testing rules for ANOVA Repeated Measures were as follows: (1) P value < 0.05: Accept Ha (2) P value > 0.05: Reject Ha.

Results

Respondent Characteristics

The data analyzed in this study includes respondent characteristics such as age, gender, and education, as detailed in the following table:

Table 1. Frequency Distribution of Respondent Characteristics by Age, Gender, and Education (n=13)

Variable	n (%) / Mean (SD)
Age, mean (SD)	
Age Range	54,2 (5,48)
Gender, n (%)	
Male	9 (69,2 %)
Female	4 (30,8 %)
Education, n (%)	
Elementary School (SD)	0 (0,0 %)
Junior High School (SMP)	3 (23,1%)
Senior High School (SMA)	7 (53,8 %)
Higher Education	3 (23,1 %)

The analysis of respondent characteristics revealed an average age of 54.2 years (SD 5.48), predominantly male (69.2%), and with a majority having completed senior high school (53.8%).

Swallowing Ability

Table 2. Distribution of Swallowing Ability (n=19)

Swallowing Ability	Mean Difference	SE	df	P value
Week 1 to Week 2	0.154	0.166	12.0	0,759
Week 1 to Week 3	-1.692	0.241	12.0	0,001
Week 1 to Week 4	-2.923	0.222	12.0	0,001

The analysis results showed that the swallowing ability of respondents between Week 1 and Week 2 had a mean difference of 0.154 with a standard error (SE) of 0.166. Based on statistical testing using Repeated Measures ANOVA, the P value for measurements from Week 1 to Week 2 was 0.759 > 0.05, indicating no significant effect of the Shaker Exercise intervention on swallowing ability for stroke patients with dysphagia between Week 1 and Week 2.

The analysis also revealed that the swallowing ability of respondents between Week 1 and Week 3 had a mean difference of -1.692 with a standard error (SE) of 0.241. The P value for measurements from Week 1 to Week 3 was 0.001 < 0.05, indicating a significant effect of the Shaker Exercise intervention on swallowing ability for stroke patients with dysphagia between Week 1 and Week 3.

Additionally, the swallowing ability of respondents between Week 1 and Week 4 showed a mean difference of -2.923 with a standard error (SE) of 0.222. The P value for measurements from Week 1 to Week 4 was 0.001 < 0.05, indicating a significant effect of the Shaker Exercise intervention on swallowing ability for stroke patients with dysphagia between Week 1 and Week 4.

The Effect of Shaker Exercise on Swallowing Ability in Stroke Patients with Dysphagia

Table 3. The Average Differences in Shaker Exercise Effects on Swallowing Ability in Stroke Patients with Dysphagia

	Sum of Squares	Df	Mean Square	F	p	η^2_p
RM Factor 1	81.75	3	27.250	115	< .001	0.906
Residual	8.50	36	0.236			

Based on the statistical test using Repeated Measures ANOVA, the P value for measurements from Week 1 to Week 4 was 0.01 < 0.05, indicating a significant effect of the Shaker Exercise intervention on swallowing ability in stroke patients with dysphagia. The effect size of 0.906 falls within the "large effect" category according to Cohen's criteria.

Discussion

Based on the statistical analysis using Repeated Measures ANOVA, the P value for measurements from Week 1 to Week 4 was 0.01 < 0.05, indicating that there was a significant effect of the Shaker Exercise intervention on swallowing ability in stroke patients with dysphagia. The effect size of 0.906 falls within the "large effect" category according to Cohen's criteria. The results of the Shaker Exercise intervention from Week 1 to Week 2 showed no effect on swallowing ability in stroke patients with dysphagia. The Shaker Exercise given to stroke patients with dysphagia for 10 days was not proven to improve swallowing ability because the swallowing muscles had not yet worked optimally. This may occur because the respondents were not yet accustomed to performing the prescribed therapy, and habitual patterns certainly influence the outcomes of exercises. The research conducted by Jacinda Choy et al (2023) indicated that in managing Shaker Exercises for stroke patients with dysphagia, assessment, observation, and early swallowing exercises are crucial, and the exercises will be more effective when performed continuously to improve the strength of the swallowing muscles. Rationale suggests that continuous training is necessary to restore the function of these muscles.[12] The analysis showed a mean difference of -1.692 for swallowing ability from Week 1 to Week 3. Based on the statistical test with Repeated Measures ANOVA, the P value for measurements from Week 1 to Week 3 was 0.001 < 0.05, indicating a significant effect of the Shaker Exercise intervention on swallowing ability in stroke patients with dysphagia.

By Week 3, respondents reported being able to perform the Shaker Exercise confidently, calmly and relaxed. The exercise, which focuses on muscle recovery, needs to be performed regularly to restore the muscle's ability. Weak swallowing muscles can return to normal if movement exercises, such as the Shaker Exercise, are done routinely. The effect of the Shaker Exercise led to improvements in swallowing ability by increasing the strength of the swallowing muscles, both the hyoid and suprahyoid muscles, which help open the Upper Esophageal Sphincter (UES) and facilitate the digestive process. Research by Choi et al. (2017) found that the effects of Shaker Exercise are most noticeable and improvements occur in Weeks 3 and 4 after the exercise.[10] The analysis also showed a mean difference of -2.923 for swallowing ability from Week 1 to Week 4. Based on the statistical test with Repeated Measures ANOVA, the P value for measurements from Week 1 to Week 4 was 0.001 < 0.05, indicating a significant effect of the Shaker Exercise intervention on swallowing ability in stroke patients with dysphagia.

By Week 4, respondents showed a high level of independence in performing the Shaker Exercise, leading to a significant improvement in swallowing ability. In this case, Shaker Exercise, which focuses on strengthening swallowing muscles, should be performed at least 15 to 20 times for optimal results. This aligns with the findings of Choi et al. (2017), who reported that swallowing ability significantly improved when the exercises were performed throughout 4 weeks.[10] These results are in line with the findings of Park et al. (2021), which show that shaker exercise can increase suprahyoid muscle strength, improve laryngeal elevation, and significantly improve swallowing ability. The study also noted that the effectiveness of the therapy became more apparent after the intervention was carried out for four weeks.[13]

The results of this study are consistent with the findings of Rofes et al. (2020), which stated that shaker exercise provides significant improvements in the pharyngeal phase of swallowing in patients with dysphagia. Their research found that the effects of the therapy became more pronounced after three weeks of intensive training. However, this study did not specifically report effect size values, so our study adds an important contribution to measuring the quantitative impact of therapy.[14] In contrast, research by Hwang et al. (2022) states that although shaker exercise is effective, better results are obtained when this therapy is combined with neuromuscular electrical stimulation (NMES). They found that this combination had a greater effect on increasing the duration of glottic closure than the shaker exercise alone. This highlights the importance of exploring additional therapies to achieve more optimal outcomes.[15] Based on the results of this study, shaker exercise can be recommended as a non-invasive intervention to improve swallowing ability in stroke patients with dysphagia. The great effects obtained show that this therapy is feasible to be implemented in dysphagia rehabilitation protocols in various health facilities. However, given the results of previous studies Hwang et al. (2022), multimodal approaches, such as combining shaker exercise with NMES, need to be considered for further research to improve the effectiveness of therapy.[15]

Conclusion

Swallowing therapies such as Shaker exercise have been proven to improve the strength of the suprahyoid muscles, which play an essential role in the oropharyngeal phase of the swallowing process. Evaluation results show a reduction in the frequency of aspiration and an improvement in swallowing ability in stroke patients with dysphagia. This exercise aligns with the principles of evidence-based nursing, supporting the use of interventions based on scientific evidence to enhance patients' quality of life. Dysphagia often leads to weight loss and the risk of malnutrition. NGT intervention and swallowing training significantly reduce these complications. Monitoring nutritional intake and modifying the diet according to recommendations from nutrition experts help prevent aspiration pneumonia and improve the patient's general condition. In addition to physical interventions, this therapy is complemented by family education on the importance of swallowing exercises. This approach not only enhances swallowing function but also provides psychosocial support to both the patient and their family.

Conflict of Interest

There are no conflicts of interest in this research.

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