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EFFECT OF THREE COMBINED SWALLOWING MANEUVERS ON SELECTED OUTCOMES AMONG PATIENTS WITH STROKE

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Abstract

Stroke is a serious life-threatening medical condition associated with dysphagia and risk for aspiration pneumonia as well as odynophagia. Unfortunately, there is no known pharmacological treatment for dysphagia, nevertheless, studies showed that combined swallowing techniques may help in neurological problems; therefore, the aim of this study is to evaluate the effect of three combined swallowing maneuvers (Mendelsohn, Effortful and Supraglottic) on severity of dysphagia with risk of aspiration pneumonia and odynophagia among patients with stroke. **Methods:** Quasi-experimental pretest-posttest nonequivalent control group design was applied on a purposive homogeneous sample of 60 adult male and female patients with a confirmed diagnosis of right hemispheric stroke for the first time was collected over six consecutive months. The first 30 recruited patients constituted the control group who received the routine hospital care only, while, the subsequent 30 patients formed the study group which was exposed to the three combined swallowing maneuvers in addition to the standard medical treatment for two weeks. Outcomes were assessed two times during intervention period; once every one week using Gugging Swallowing Screen (GUSS) and Pain Numeric Rating Scale (PNRS). **Results:** The results showed at pre-intervention time that there are no statistically significant differences between the two study groups with regard to all study variables that were to be measured. On the other hand, the total post severity of dysphagia with risk of aspiration pneumonia mean scores among the participants in the study group who practiced the combined swallowing maneuvers were higher than the total post severity of dysphagia with risk of aspiration pneumonia mean scores of the control group with a mean difference score of 2.867 (t = -4.596 & P = 0.000) along the two weeks. Regarding odynophagia, the total post severity of odynophagia mean scores among the participants in the study group were statistically lower than the total post severity of odynophagia mean scores of the comparison group with a mean difference score of 1.767 (t = 3.695 & P = 0.000) along the two weeks. **Conclusion:** Combining Mendelsohn, Effortful and Supraglottic swallowing maneuvers had a significant positive effect on reducing severity of dysphagia with risk for aspiration pneumonia and odynophagia among patients with stroke, hence, it is recommended to be integrated with standardized hospital routine care for those group of patients.

Keywords: Stroke, Cerebrovascular, Dysphagia, Risk of Aspiration Pneumonia, Odynophagia, Swallowing Exercises, Mendelsohn Maneuver, Effortful Swallowing, Supraglottic Swallowing.

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1. INTRODUCTION

Stroke is a cerebrovascular disease (CVS); recognized as a neurological deficit of sudden onset attributed to vascular injury of the Central Nervous System (CNS), with symptoms lasting more than 24 hours. Infact, stroke is one of the five causes of disability and death worldwide [1-2]. Stroke occurs when a blood vessel in the brain bursts or become blocked, which results to insufficient blood and oxygen to reach the brain's tissues leading to tissue distruction and possible death within minutes [3].

Symptoms of stroke depend mainly on the affected part of the brain [4]. One of the most common symptoms in patients with ischemic or hemorrhagic stroke is difficulty in swallowing which is known as dysphagia that affect a third to over two thirds of patients [2]. Basically, the swallowing process consists of three phases including oral, pharyngeal and esophageal; with a stroke each of these phases may be affected [5]. If swallowing does not improve within ten days post stroke, it may take between two to three months to show signs of recovery [6]. Notwithstanding, some patients appear to have a safe swallow at three months and about 11 to 50 percent of the affected patients still had dysphagia for six months after stroke [7].

Health team members use the terms dysphagia and odynophagia interchangeably; although, they differ in meaning. Dysphagia occurs when someone feels difficulty in any phase of the swallowing without any pain [8], while, odynophagia happen when someone feels pain or discomfort while swallowing high in throat or lower down behind the breastbone as like a strong sensation of squeezing or burning; also patient may feel chest pain or food stuck in the throat and heaviness or pressure in the neck or upper chest while eating [9].

Signs and symptoms associated with dysphagia might include pain while swallowing that may cause inability to swallow, sensation of food getting stuck in the throat or behind sternum, drooling, hoarseness, regurgitation of food, frequent heartburn, food or stomach acid backing up into the throat and coughing or gagging. On the other hand, complications such as weight loss, malnutrition, dehydration, choking and aspiration pneumonia which is considered one of the worst complication that might occur with a mortality rate of up to 45% [10]. Although the majority of the patients cannot prevent the difficultly of swallowing, they at least can ask the health care providers to provide appropriate instructions to reduce its consequences [11-12].

The management of dysphagia remains a developing field, and the available robust evidence base is limited to develop care pathways and identify the best practice [8]. Though, the primary aim of dysphagia management is to reestablish safe oral feeding, prevent aspiration and manage swallowing difficulties [10]. Currently, there is no known pharmacological treatment for dysphagia, but many studies have investigated a variety of interventions depending on the type and cause of swallowing disorder including behavioral; electrical or magnetic stimulation; dietary modification; altering posture and swallowing exercises which may be used independently or together [13]. However,

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treatment approaches for esophageal dysphagia might include surgery, supportive medications and corticosteroids or muscle relaxants [12].

Previous studies have shown that swallowing exercises and new swallowing techniques may help in relieving neurological problems associated with stroke through coordination of swallowing muscles; re-stimulation of the nerves and rewiring the brain [5]. As a matter of fact, previous research studies had proven that combining a variety of exercises such as Mendelsohn Maneuver, Effortful Swallowing, Supraglottic Swallowing, Super-Supraglottic Swallowing can improve swallowing difficulties with these patients [14]. Taking into account that each type of exercise works in a different way on different parts and different functions of swallowing which makes selecting the three following exercises combined by the researcher the ideal selection for stroke patients.

Mendelsohn Maneuver improves the swallowing function through the activation of suprahyoid swallowing muscles and increasing the duration of laryngeal elevation. While, Effortful Swallowing has a positive impact on muscle strength and reduces aspiration through increasing movement of the hyoid bone. On the other hand, Supraglottic Swallowing and Super-supraglottic swallowing exercises enhance closure of the airway at the level of the true vocal folds before and during the swallow to prevent food or liquid from going into lungs and clear residue afterwards. Hence and it goes without saying, performing these exercises combined requires that the patient should be able to follow directions, be alert and be able to exert the physical effort to perform the above mentioned maneuvers correctly [15].

Nurse is a key member of health care team because nurse at the epicentre of service provision at hospitals and in more contact with patients. Indeed, nurses play a variety of role in caring for patients with difficulty swallowing including assessment of signs and symptoms; documenting progression to detect any swallowing disorder; implementing different feeding strategies to provide safe eating methods; providing necessary emotional and informational support and teaching patients different maneuvers of swallowing exercises to establish the safest route for food [16-17].

Though, literature review and previous research studies documented that swallowing techniques have significant effected on severity of dysphagia and swallowing ability among patients with cerebrovascular stroke. Still, there is lack of evidence to evaluate the effect of combining Mendelsohn Maneuver, Effortful Swallowing and Supraglottic Swallowing in reducing severity of dysphagia with risk for aspiration pneumonia as well as odynophagia among patients with stroke; therefore, the aim of this study was to evaluate the effect of combining these three swallowing maneuvers (Mendelsohn, Effortful Swallowing and Supraglottic Swallowing) on severity of dysphagia with risk for aspiration pneumonia and odynophagia among patients with stroke.

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2. METHODS

2.1 Aim

The aim of this study was to evaluate the effect of combining these three swallowing maneuvers (Mendelsohn, Effortful Swallowing and Supraglottic Swallowing) on severity of dysphagia with risk for aspiration pneumonia and odynophagia among patients with stroke. All hypotheses were accepted at a 0.05 level of significance. To fulfill the aim the following hypotheses were postulated:

H1. The total post severity of dysphagia and risk for post stroke aspiration pneumonia mean scores among patients with stroke who will practice the combined three swallowing maneuvers will be different than the total post severity of dysphagia and risk for post stroke aspiration pneumonia mean scores of a control group along two weeks.

H2. The total post severity of odynophagia post stroke mean scores among patients with stroke who will practice the combined three swallowing maneuvers will be different than the total post severity of odynophagia post mean scores of a control group along two weeks.

2.2 Research Design

Quasi-experimental pretest - posttest nonequivalent control group design was utilized in this study, where, the researchers estimated the causal impact of combining three swallowing maneuvers (independent variable) on severity of dysphagia with risk for aspiration pneumonia and odynophagia (dependent variable) among patients with stroke

2.3 Setting

This study was conducted in the Neurology Department as well as the Neurology Outpatient clinic affiliated with Al-Kasr Al-Aini University Hospitals, Cairo, Egypt.

2.4 Description of the Participants

A purposive homogeneous sample over six consecutive months of 60 adult male and female patients with a confirmed diagnosis of right hemispheric stroke for the first time were recruited for the study. Criteria for potential participants were that they complain from mild or moderate dysphagia based on assessment of Gugging Swallowing Screen (GUSS) and got consciousness level between 13-15 scores on Glasgow Coma Scale. In addition, the following inclusion criteria were established: (a) able to communicate and exert the physical effort to perform the maneuvers (b) can read and write. Patients with cognitive impairment, head and neck injuries and /or cancer and have nasogastric tube were excluded from the study. The study sample was divided into two equal groups. The first recruited 30 patients constituted the control group who received the standardized hospital care, while, the subsequent 30 patients formed the study group which exposed to the three combined swallowing maneuvers.

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2.5 Data Collection Tools: The data was collected using the following four tools:

Glasgow Coma Scale (GCS). It was designed to assess the level of consciousness of patients. The total scores range from 3-15. The researcher used this tool to assess the consciousness level of potential participants; if the patient earned 13-15 scores, the patient was eligible to participate in this study [18-19].

A Personal and Medical Data Form (PMDF). It was developed by the researcher based on extensive literature review. It consists of two parts; the first part included personal data such as patient's age, gender, level of education, marital status and place of residence … etc. Whilst the second part, covered medical data including date of admission, type of stroke, areas affected in the brain, past medical history and family history … etc.

Gugging Swallowing Screen (GUSS). This tool, basically was developed to assess the association between severity of dysphagia and risk for post stroke aspiration pneumonia. The tool consists of fifteen items divided into two main parts, the first part assess ***indirect swallowing*** that covers five items (vigilance, cough, saliva swallow, drooling and voice change), whereas the second part covers ***direct swallowing*** that test the patient's ability to swallow semi-solid, liquid and solid, each part contains four items (deglutition, cough, drooling and voice change) [20].

The total score for this tool ranges from Zero to 20 and are divided between the two parts. The first part has a total score of five, while the second part has a total score of 15 and is distributed equally among the three previously mentioned subtests. If any of the research participants doesnot obtains the total scores in one of the subtests, the researcher does no complete the remaining subtests. The scores are interpreted as follows; if the total scores was 20, it means no dysphagia and no risk for aspiration pneumonia, but, if the total score is from 15 to 19, it classifies as mild dysphagia and mild risk for aspiration pneumonia, however, if the total score is from 10 to 14, it classifies as moderate dysphagia and moderate risk for aspiration pneumonia and if the total score ranges from 0 to 9, it means severe dysphagia with a high risk for aspiration pneumonia [20].

Pain Numeric Rating Scale (PNRS). The researcher used this tool to check the severity of odynophagia post stroke. The tool consists of 11 items, likert scale ranging from zero to ten. It is a self-reported scale with no pain equals zero, mild pain from one to three, moderate pain from four to six, and severe pain over seven [21].

2.6 Procedure: The study was carried out through the following phases**.**

Preparatory Phase. During this phase, the researcher prepared the flyer in a simple Arabic language supported by many pictures. This flyer included among many other items the normal swallowing process, definition of dysphagia, causes of dysphagia and the combined swallowing maneuvers and it was handed to all participants in the study group. In addition, face and content validity of the Arabic translated study tools were established by a panel of three experts from the Medical Surgical Nursing Department and Neurology Department - Cairo University. Nevertheless, upon receiving the initial approval from

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Research Ethics Committee at Faculty of Nursing, an official permission was obtained from the hospital administrator's authority to conduct the proposed study.

During this phase also, the researcher collected data from the eligible hospitalized participants using Glasgow Coma Scale (GCS) and Gugging Swallowing Screen (GUSS) to select potential participants who met the initial criteria for inclusion. Midst this phase also, the nature and the aim of the study were explained, and those who choose to participate was asked to sign the written consent form. These tools took between 30 - 45 minutes.

Implementation Phase. The researcher collected the data from the participants in the control group first to avoid contamination; those patients received the routine hospital care that often consists of a combination of exercises as tongue exercise, chin exercise and tracheal shafting maneuver once per day until patient discharged. Then, data collection started from the participants in the study group who received the three combined swallowing maneuvers. During this phase, the researcher established baseline data about participants' in both groups using Personal and Medical Data Form (PMDF) and Pain Numeric Rating Scale (PNRS). This took approximately 60 to 90 minutes.

Thereafter, each participant in the study group was instructed individually about swallowing maneuvers; the instruction is integrated simultaneously with practice as well as demonstration and re-demonstration that propped with the developed flyer. The researcher provided two sessions per day, one in the morning and the other in the afternoon in two consecutive days which is equivalent to four sessions with break in between depending on patients' tolerance; each session lasted approximately 45 to 60 minutes.

Participants were instructed to carry out these swallowing maneuvers twice a day for 30 to 40 times per session, guided by the Arabic flyer. They were briefed also that they could stop at a minimum of 30 times if they develop any sign of uncomfortable or fatigue [14, 22, 23]. The researcher further emphasized the importance of adherence to attain the effect of swallowing maneuver and communicated with the relative of the participant to encourage them to perform the swallowing maneuver during the visiting period and suggested to perform the exercise during eating semisolid food. Moreover, the researcher was available in person or on the phone during the intervention period to answer any question or to clarify any vague or incomprehensible step to ensure the participant ability to perform the required swallowing maneuvers.

The researcher demonstrated the combination between the three swallowing maneuvers to patient as follows: (a) ask the patient to sit in a comfortable position on a chair or bed, (b) take a breath and initiate swallowing while putting fingertips on the neck to feel Adam's apple moving upward and downward, (c) take another breath and initiate swallowing again while pushing the tongue firmly against the hard palate and try to hold in this position for three to five seconds so the researchers recommended to bit on the teeth to keep in this position until the next step of swallowing (d) swallow as forcefully as possible squeezing the neck muscles and cough immediately after swallowing.

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Evaluation Phase. The researcher monitored the selected outcomes among both groups after a full week using Gugging Swallowing Screen (GUSS) and Pain Numeric Rating Scale (PNRS). Otherwise, the second post intervention assessment was carried out after two whole weeks, however, if the patient was discharged from the hospital before the second post intervention assessment, the researchers followed the participants up daily through phone calls and performed the second post intervention assessment in the outpatient clinic. Upon completion of the data collection, participants in the control group were given a copy of the Arabic flyers to apply principles of fairness and justices in conducting research.

2.7 Statistical Analysis

The collected data was scored, tabulated and analyzed by personal computer using SPSS program version 20 [24]. Descriptive statistics such as frequency, percentage, variable means and standard deviation were used, in addition to, inferential statistics including independent t-test, also chi square for categorical data to identify differences between the groups.

3. RESULTS

3.1 Description of Participants

Table 1: A comparison between the Study and the Control Groups regarding Demographic Characteristics (N= 60)

Variables	Study group		Control group		χ^2	p-value
	N	%	N	%		
Age/years					5.814	0.325
20-	2	6.7%	2	6.6%		
40-	12	40%	13	43.4%		
60-80	16	53.3%	15	50%		
$\bar{X}$ ± SD = 57.27 ± 11.00						
Gender					1.086	0.297
Male	19	63.3%	15	50%		
Female	11	36.7%	15	50%		
Marital status					4.022	0.259
Single	0	0.0%	2	6.7%		
Married	23	76.7%	22	73.3%		
Divorced	1	3.3%	3	10%		
Widowed	6	20%	3	10%		
Educational level					1.405	0.704
Can read and write	12	40%	16	53.3%		
Primary	6	20%	6	20%		
Secondary	7	23.3%	5	16.7%		
Bachelor	5	16.7%	3	10%		
Smoking status					0.268	0.605
Smoker	15	50%	13	43.3%		
Non-smoker	15	50%	17	56.7%		

* $P \leq 0.05$

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Table 2: A Comparison between the Study and the Control Groups regarding Medical Data (N= 60)

Variables	Study group		Control group		χ^2	p-value
	N	%	N	%		
Comorbidities Hypertension					0.077	0.781
Yes	20	66.7%	21	70%		
No	10	33.3%	9	30%		
Diabetes					1.684	0.194
Yes	11	36.7%	16	53.3%		
No	19	63.3%	14	46.7%		
Other diseases					0.082	0.774
Yes	8	26.7%	9	30%		
No	22	73.3%	21	70%		
Family history					0.635	0.426
Yes	10	33.3%	13	43.3%		
No	20	66.7%	17	56.7%		
Types of stroke					2.308	0.129
Ischemic	24	80%	28	93.3%		
Hemorrhagic	6	20%	2	6.7%		

*P ≤ 0.05

Table (1and 2) testify that there are no statistically significant differences between the control and the study group in demographic characteristics and medical data. Actually, the majority of both groups were male, married and can read and write with a mean age of 57.27 ± 11.00 years. As for the medical data, the majority of both groups had hypertension followed by diabetes. Ischemic stroke were also common among the two groups respectively and there was no family history of stroke.

3.2 Testing of the Research Hypotheses

Table 3: A comparison of the Total Mean Scores of the Severity of Dysphagia and Risk for Post Stroke Aspiration between the Study and the Control Groups at Different Times of the Study (N= 60)

Time of assessment	Study group (n=30) $\bar{X}$ ± SD	Control group (n=30) $\bar{X}$ ± SD	T	p-value
Pre-intervention	12.90 ± 1.954	13.90 ± 2.482	1.734	0.088
Mean difference = 1.00				
One week post-intervention	16.07 ± 2.196	14.63 ± 2.539	-2.339	0.023*
Mean difference = -1.433				
Two weeks post-intervention	18.70 ± 1.579	15.83 ± 3.030	-4.596	0.000***
Mean difference = -2.867				

* P ≤ 0.05 **P ≤ 0.01 ***P ≤ 0.000

It is apparent from table (3) that there was no statistically significant differences in the total severity of dysphagia with risk of aspiration pneumonia mean scores at the pre-intervention assessment time (t =1.734 & P = 0.088) with a mean difference score of 1.00 between the two groups. But, a week after implementation, there was a statistical

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significant difference in the total mean scores between both groups (t = -2.339 & P = 0.023) as the mean scores were 16.07 ± 2.196 in the study group compared to 14.63 ± 2.539 in the control group with a mean difference score of 1.433. Moreover, a high statistical significant differences in the total mean scores between both groups two weeks post-intervention assessment was found (t = - 4.596 & P = 0.000) as the mean scores in the study group continued to rise in comparison to the control group (18.70 ± 1.579; 15.83 ± 3.030 respectively) with a mean difference score of 2.867. Therefore, the first hypothesis was supported.

Table 4: A Comparison of the Total Mean Scores of the Severity of Odynophagia Post Stroke between the Study and the Control Groups at Different Times of the Study (N= 60)

Time of assessment	Study group (n=30) $\bar{X}$ ± SD	Control group (n=30) $\bar{X}$ ± SD	T	p-value
Pre-intervention	5.23 ± 3.287	3.83 ± 3.384	-1.625	0.110
Mean difference = -1.400				
One week post-intervention	2.53 ± 1.925	3.40 ± 3.114	1.297	0.200
Mean difference = 0.867				
Two weeks post-intervention after	0.47 ± 0.973	2.23 ± 2.431	3.695	0.000***
Mean difference = 1.767				

* P ≤ 0.05 **P ≤ 0.01 ***P ≤ 0.000

Table (4) explicates that no statistical significant differences between the two groups in the total severity of odynophagia mean score at the pre-intervention assessment time (t =-1.625 & P = 0.110) as the mean scores for the two groups were 5.23 ± 3.287 in the study group compared to 3.83 ± 3.384 in the control group with a mean difference score of -1.400. Nevertheless, one week after the implementation still no statistically significant differences in total mean score between the two groups (t = 1.297 & P = 0.200) with a mean difference score of 0.867 in favor of the study group. Yet, two weeks post interventions a high statistically significant differences in total mean score between both groups (t = 3.695 & P = 0.000) with a difference in the mean score of 1.767. Hence, the second hypothesis was partially supported.

4. DISCUSSION

The study showed that the majority of ages in both groups fell between 60 < 80 years old, with a mean age of 57.27 ± 11.00. This result is congruent with study titled ‘‘Effect of Early Dysphagia Screening, Feeding Strategies and Oral Care on Occurrence of Stroke Associated Pneumonia among Critically Ill Patients with Acute Stroke’’ which showed that the ages of their participants range from 51 to less than 60 years old with a mean age 55.75 ± 6.08 [25]. However, the same finding contradicts with a study titled ‘‘Effect of Swallowing Exercise Training on Dysphagia and Quality of Life among Patients Following Cerebrovascular Stroke” which reported that the majority of participants’ age ranged between 40 < 60 years [26]. These results support medical theories that indicate people

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after the age of 55 are more susceptible to stroke than younger people [27] and this is due to the physiological changes that may occur in the circulatory system with increasing age.

The fact that the majority of the study participants are married is harmonious with the ages of the participants in the current study and previous studies [26], [28] may provide further explanation for the finding as marriage add social, economic and physical demands that leads to an increase in psycho-social pressures which in turn lead to occurrence of high blood pressure and diabetes, which are among the recognized comorbidities of stroke as evidenced by this study finding. This finding is also in the same line with previous research studies which authenticated that hypertension followed by diabetes mellitus are the highest chronic disease concomitant with dysphagia in stroke, in addition to documents providing the existence of a strong relationship between hypertension, diabetes and the occurrence of stroke [26], [27-29]. Surprisingly, the family history of the sample in the current study has no relation to the occurrence of stroke, nevertheless, it was inconsistent with literature which documented that one of the risk factors for stroke is family history which is related to the genetic family profile [3], [30].

It is a well- known fact that women are more susceptible to stroke than men, but in this study the number of men is greater than the number of women. This result is congruent with results of previous studies [26], [27], however, opposed with an early study that reported stroke is the fifth leading cause of death for women diagnosed with hypertension during pregnancy, using birth control pills or after menopause [25], [31]. All these findings can be partially explained in light of the fact that gender difference as men have higher risk of stroke than women but when women are older, they have more stroke incidence than men [32].

The current study showed that more than three quarters of the sample was diagnosed with ischemic stroke. This result is consistent with the latest reports that about 87 percent of all strokes are ischemic [25-26]. This type of stroke is usually seen in older persons, especially those with high cholesterol and atherosclerosis or diabetes [33]; all these are some of the distinct medical characteristics of this research sample.

The statistical analysis of the first hypothesis indicated that there are no statistical significant differences in the total post severity of dysphagia with risk of aspiration pneumonia mean scores at the pre-intervention assessment time, however, the total post severity of dysphagia with risk for aspiration pneumonia mean scores among patients with stroke who practiced the three combined swallowing maneuvers was better than the total post severity of dysphagia with risk for aspiration pneumonia mean scores of a control group along the two weeks of intervention in favor of the study group. Therefore, the first hypothesis was supported.

The most appropriate explanation for the differences between the two groups is the use of three swallowing maneuvers combined in the study group where Mendelsohn maneuver activates the swallowing muscles and open of the upper esophageal sphincter for a prolonged time, while Effortful swallowing focuses on the activation of swallowing

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muscles through improving the contact between the base of the tongue (BOT) and the posterior pharyngeal wall (PPW) that increase pressure duration in the mid pharynx and produce higher pressure in the upper esophageal sphinter (UES) for a short duration and supraglottic swallow aim to improve airway protection [14]. Also, the strength of the tongue base and esophageal muscles, enhance the coordination of swallowing muscles or re-stimulate the nerves that trigger the swallowing reflex consequently improvement of airway protection.

In addition to the main reason mentioned previously, there may be subsidiary reasons that help explain the differences between the study and the control groups, which can be summarized in: (a) the provided informational and practical sessions for patients in the study group, while giving the patient the chance to ask questions about issues that deemed vague or incomprehensible and (b) the illustrated booklet that was developed by the researcher and given to all participants in the study group which contains many clear and concise information supported with many pictures illustrating the intervention for the study group.

Despite the lack of evidence to evaluate the effect of the three combined maneuvers on severity of dysphagia with risk for aspiration pneumonia among patients with stroke. There are some few studies that have evaluated the effect of one or two maneuvers on patients with stroke. Generally speaking, based on the literature, treatments with any of the three maneuvers alone or in combination have led to an improvement in the state of swallowing difficulty in these patients [14-15], [23].

Here are some studies that discussed the effect of one exercise on dysphagia and risk of aspiration pneumonia among these patients for example “Effects of Mendelsohn Maneuver on Measures of Swallowing Duration Post-Stroke’’ which showed an improvement in the swallowing physiology, yet, the authors suggested combining this maneuver with other rehabilitation treatments to improve bolus flow and dysphagia severity [23]. Another study recommended Effortful swallowing training as a remedial rehabilitative strategy as it could improve physiologic aspects of swallowing phases [34-35]. Moreover, an earlier study demonstrated that Supraglottic Swallowing and Super-supraglottic Swallowing exercises enhance closure of the airway at the level of the true vocal folds before and during the swallow to prevent food or liquid from going into lungs to prevent aspiration pneumonia [15]

On the other hand, the following studies recited the effect of combining more than one exercises for example a study carried by Kim et al., (2017) [14] declared that the combined method of the Mendelsohn maneuver and effortful swallowing has a positive effect on reducing aspiration pneumonia in patients with dysphagia after stroke. These results are also consistent with what was mentioned in the literature that combining rehabilitative maneuvers such as Masako, Mendelson, supraglottic and effortful swallow contributed to 95% in rehabilitation of swallowing disorders among these patients [36].

The statistical analysis of the second hypothesis indicated that there are no statistical significant differences in the total post severity of odynophagia mean scores at pre-

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intervention assessment time, however, the total post severity of odynophagia post stroke mean scores among patients who practiced the three combined swallowing maneuvers was less than the total post severity of odynophagia post mean scores of a control group along the two weeks of intervention in favor of the study group. Hence, the second hypothesis was supported. In addition to the explanations mentioned in the previous part to explain the reasons for the statistical differences between the study group and the control group, it is certain that strengthening the muscles of the face and neck using exercises may be the reason for reducing the feeling of pain when swallowing, and this is in line with a recent research which documented that one approach in treatments of odynophagia and dysphagia was exercises [37]. Also, patient's commitment to performing the exercises that were given to them, as well as the adherence to modification that was made in the quality and quantity of food, undoubtedly played a role in this differences.

5. CONCLUSION AND RECOMMENDATION

It can be concluded from this study that combining Mendelsohn, Effortful and Supraglottic Swallowing maneuvers had a significant effect in improving the severity of dysphagia, decreasing the risk of aspiration pneumonia and reducing pain during swallowing among patients with stroke. Accordingly, it may be recommended to incorporate swallowing maneuvers into the current treatment protocols for patient with stroke.

6. LIMITATIONS

Although every effort was made to conduct this study as described in the protocol, inevitably certain limitations existed and should be considered when interpreting the results. These limitations were:

- The findings in this study were limited to the studied groups as the sample was not randomly selected. Therefore, it isn't necessarily representative of the general population of stroke patients.
- Study finding are limited in generalizability due to the fact that the sample was selected from one geographical area in Egypt.

Abbreviations

CDC	Centers for Disease Control and Prevention
CVS	Cerebrovascular disease
GCS	Glasgow Coma Scale
GUSS	Gugging Swallowing Screen
IBM	International Business Machines
PMDF	Personal and Medical Data Form
PNRS	Pain Numeric Rating Scale
SLP	Speech Language Pathologist

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DECLARATIONS

1. Ethical Considerations: This study was part of a Doctorate dissertation, approved by the Research Ethics Committee of Faculty of Nursing, Cairo University (ethics code: RHDIRB2019041701); the study number is 2022-103. In addition, a written informed consent was obtained from all participants after explaining the nature, purpose and significance of the study as well as the expected benefit and/or risk. It was emphasized also that participation in the study is entirely voluntary and they have the right to withdraw from the study at any point without penalty.

2. Availability of data and materials: The data that support the findings of this study are available from the corresponding author upon reasonable request.

3. Competing interests: The authors declare that they have no competing interests.

4. Funding: This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
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