Effect of Swallowing Training Rehabilitation Program on Severity of Dysphagia and Swallowing Trial among Patients with Cerebrovascular Stroke

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Abstract

Background: Cerebrovascular Stroke (CVS) is a rapidly developing clinical focal disorder of cerebral function lasting for 24 hours or longer and leading to death, with no obvious reason other than the vascular source. **Aim of the study:** was to determine the effect of swallowing training rehabilitation program on severity of dysphagia and swallowing trial among patients with cerebrovascular stroke **Research design:** A quasi experimental research design with a pretest-posttest control group was utilized. **Settings:** The study was conducted at neurological inpatient units at Alexandria University Hospital. This hospital was selected because flow rate of patients with cerebrovascular stroke was satisfactory for the study**. Subjects:** Purposive samples of 60 hospitalized adult patients with CVS were selected according to eligibility criteria. They were divided into two equal groups 30 in each study group and control group. **Tools of data collection:** three tools were used for data collection namely: Patients' demographic characteristics and clinical data sheet, dysphagia severity scale and observation checklist to assess swallowing ability during swallow trial: **Results:** the study results revealed that there was a statistically significant difference between the study and control groups in favor of the former in relation to severity of dysphagia and swallowing trial after two weeks and one month of intervention in which the severity of dysphagia decreases among study group to 20% and 13.3% respectively in level (1) after two weeks and one month while the severity of dysphagia increases among control group to 40% and 66.7% respectively in level (1) after two weeks and one month with P = 0 .000. **Conclusion:** The study concluded that swallowing training rehabilitation program has significant positive effect on severity of dysphagia and swallowing trial among patients with cerebrovascular stroke. **Recommendation:** The developed booklet with its simple instructions and illustrations should be utilized in hospitals as a teaching aid for patient with dysphagia. Periodic health education programs for nurses to create awareness on swallowing exercises in improving swallowing ability.

Keywords: Cerebrovascular stroke, Dysphagia, Swallowing training program

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Introduction

Cerebrovascular Stroke (CVS) is a rapidly developing clinical focal disorder of cerebral function lasting for 24 hours or longer and leading to death, with no obvious reason other than the vascular source. It occurs as a result of interrupted arterial blood flow to a part or parts of the brain. It recognized as the most common cause of functional disability worldwide and considered the third leading cause of death in the USA. It is associated with multiple medical complications leading to increasing mortality and morbidity

(Padma et al, 2016). More than 150 000 people with stroke die each year. There are 5.5 million CVS survivors in the USA and it is estimated that about 13 million individuals had sustained the so-called 'silent' stroke **(American Agency for Health Care Policy and Research, 2016)**. In Egypt, according to recent statistical estimation the overall prevalence rate of stroke is high with a prevalence rate of 963/100 000 inhabitants. **(Abd-Allah and Moustafa, 2014)**

Stroke is divided into two major categories; ischemic and hemorrhagic **(Amy and Collins, 2015).** The American Stroke Association reported that the majority of strokes is ischemic and account for 88% of all strokes. In ischemic stroke, the blood flow is interrupted by total or partial occlusion of a cerebral artery by a thrombus or an embolus. **(American Agency for Health Care Policy and Research, 2016)**. Hemorrhagic stroke results from extravasation of blood in the brain tissues or into the subarachnoid space. Stroke can affect any part from the four parts of the brain: right hemisphere, left hemisphere, cerebellum or the brain stem **(Carr and Shepherd, 2017).**

Cerebrovascular stroke affects many body functions including: neuro-motor activity, intellectual, sensory, elimination and communication functions. Dysphagia is considered one of the most common symptoms in patients with acute ischemic or hemorrhagic stroke. It is a disruption of the bolus flow through the mouth and pharynx **(Kumar, Selim and Caplan 2010).** Dysphagia results from weakness and structural problems of both oral and throat muscles and can result in entering food and/or liquids in the trachea instead of the esophagus leading to aspiration pneumonia with a mortality rate up to 45%. It manifested by excess production of saliva, drooling, coughing or choking during eating and even difficulty speaking or a hoarse voice. It is a symptom of a disease and it is not generally considered a major cause of mortality, but its complications are the most common causes of death. The prevalence rate of dysphagia ranged from 14% to 94% among patients with stroke and some of them recover swallowing spontaneously **(Mourão et al, 2016).** Stated that about 11–50% of the affected patients still had dysphagia for six months after the acute stroke.

The presence of dysphagia among patients with stroke substantially leads to psychosocial, medical and economic problems as it increases length of hospital stay. Aspiration pneumonia, dehydration, malnutrition and weight loss are examples of medical complications of dysphagia **(Hines et al, 2011; Sura 2012, Keage et al, 2015;).** Therefore, initial screening of dysphagia is critical to prevent future health complications and should have the higher priority during the health-care practices **(Teasell et al,. 2016, Amy and Collins; 2015)**. A study conducted by (**Blackwell and Littlejohns, 2010)** stated that, dysphagia estimated that about 56% of patients with CVS could lead to serious and life-threatening complications including nutritional deficiency, aspiration pneumonia and immune-compromised health problem.

Nurses play a critical role in the management of patients with swallowing problems because there is no pharmacological treatment for dysphagia so the main management is swallowing rehabilitation program. The goal of swallowing rehabilitation program is to reestablish safe oral feeding to a normal level as possible. The swallowing rehabilitation program begins after a detailed swallowing evaluation has been completed. Swallowing dysfunction and

its complications are common in patients with stroke, thus the swallowing function should be assessed in all acute stroke patients. Based on the nature of the swallowing problems the rehabilitation program is implemented (**Ultra-Mobile Personal Computer Swallowing Disorders Center, 2015).**

Rehabilitation program for patients with dysphagia requires a multidisciplinary team approach in which the nurse is an integral member whereas; identifying swallowing difficulty in patients with stroke is an important task in nursing care. This implies that care needs to be adapted and when rehabilitation strategies are applied they reduce the risk of complications that related to dysphagia. Frequently the nurse is the first health team member who detects and assesses signs and symptoms of dysphagia. Consequently, the nurse has her/his role in managing the patient's mealtime, documenting progress, teaching safe feeding practices and reinforcing the compensatory strategies for successful rehabilitation **(Hines, Kynoch & Munday 2016).**

Swallowing rehabilitation program comprises dietary modifications which is modifying the consistency of solids and liquids for their easy and safe swallowing; postural changes of the head and neck to facilitate the bolus flow by gravity; starting the swallowing techniques which are used to prevent pocketing of bolus and protecting the airway **(Hebert 2016).** Oral motor exercises as Shaker Exercise, Hyoid Lift Maneuver, Mendelsohn Maneuver, Gargling, Tongue Exercises, Stretch Exercise, Masako Maneuver and Postural Changes are exercises designed to strengthen and coordinate movement of the oral structure muscles **(Schaefer 2010, Kim 2015, Altman & Hines et al.; 2016)**.

The Shaker exercise is a series of sustained and repetitive head lifting exercises to enhance the strength of infrahyoid and suprahyoid muscular activity **(Altman 2010, Abd-Allah, 2014).** Shaker exercise includes isometric and isotonic exercises. Isometric exercises are performed by raising the head up for 60 seconds followed by a minute rest for a repetition of three times. Isotonic exercises which are performed by thirty repetitions of alternate up-and-down movement of the head. This enhance the contraction of the thyrohyoid muscle, strengthens the suprahyoid muscles, facilitates the upward and forward movement of the larynx and thereby opens the upper esophageal sphincter (UES) **(Blackwell 2010, American Stroke Association 2017, Padma et al,. 2016)** .Moreover, Shaker exercise also improves both infrahyoid and suprahyoid muscular activity and reduces pyriform sinus residue and backflow aspiration.This exercise has been generally used in cases of oropharyngeal dysphagia due to abnormal UES opening **(Altman 2010, Abd-Allah 2014).**

Shaker et al, 2013 have reported a significant increase in the opening of UES with Shaker exercise in patients with dysphagia with poor UES opening **(Hines 2016)**. Moreover, clinical trials and post therapy reported from various institutes stated that, the amount of aspiration was significantly less in those clients who performed Shaker exercise than the traditional swallowing therapies. Shaker exercise facilitates oesphysiologic changes in the suprahyoid muscles due to its close proximity with the pharyngeal muscles **(Padma et al,. 2016)**.

Significance of the study

Dysphagia not only escalates morbidity and mortality rate after stroke, but also significantly affects the quality of

life of patients with stroke. Where, it is impossible for patients with dysphagia to share their meals with family and friends. Also it may increase the health care costs and patients' hospital length of stay. Therefore, it is important for primary care nurse to screen and evaluate swallowing functions for patients with stroke to detect dysphagia and prevent or decrease its complications. In addition, nursing interventions should include rehabilitative interventions for safe swallowing. As swallowing exercises is considered an effective therapy of dysphagia in patients with CVS which can strength muscles and improving the functional and physiological changes in swallowing ability. Swallowing rehabilitation program is one of the suggested solutions to manage dysphagia. In spite of dysphagia is common in Egypt and its prevalence rates are higher when compared to other reports, there is lack of evidence to evaluate the effect of swallowing rehabilitation program in reducing dysphagia among patients with stroke in Egypt so the current study might provide evidence and it will be add to the body of the nursing knowledge. Therefore this study is done to investigate the effect of swallowing training rehabilitation program on severity of dysphagia and swallowing trial among patients with cerebrovascular stroke.

Aim of the study

The aim was to evaluate the effect of swallowing training rehabilitation program on severity of dysphagia and swallowing trial among patients with cerebrovascular stroke.

Research hypotheses

H0: Patients with cerebrovascular stroke who receive swallowing training rehabilitation program will exhibit the same severity of dysphagia as those who don't receive it.

H1: Patients with cerebrovascular stroke who receive swallowing training rehabilitation program will exhibit less severity of dysphagia than those who don't receive it.

Materials and method

Study design: A quasi experimental research design with a pretest-posttest for control group was utilized

Setting: The study was conducted at neurological inpatient units at Alexandria University Hospital. The unit includes 7 rooms with 30 beds and one intensive care unit with 10 beds. This hospital was selected because the flow rate of patients with cerebrovascular stroke was satisfactory for the study aim. It is one of the largest medical sectors in the Alexandria Governorate and provide many citizens in the governorates of Alexandria, Beheira, Marsa Matrouh and other governorates with medical and curative services.

Subjects: The study subjects were selected through a non-probability sampling technique. A purposive sample of 60 CVS hospitalized adult patients were recruited from the previously mentioned setting and were available at time of data collection.

The sample size was calculated by statistical power analysis of patients' admitted to the neurology unit in Alexandria university hospital.

Subjects estimation method:

G power Program
Medium effect size =0.4
Power= 80%

Alpha error=5%

Minimum required sample size=52.

The study subjects enrolled in this study according to the following inclusion criteria

1.1-2 days of acute stroke
2.Conscious and oriented
3.With no sensory deficit
4.Aged from 21-60 years old
5.Willing to participate in the study.

The selected patients were then divided into two equal subgroups of 30 patients in each (study and control)

Tools: Three tools were used to collect the necessary data.

Tool 1: Patients' demographic characteristics and clinical data sheet: It included three parts:

Part A: Demographic characteristics: This part was developed by the researchers to gather the necessary data regarding age, gender, level of education and occupation.

Part B: Medical data. This part was developed by the researchers to gather the necessary data regarding previous cerebrovascular stroke, type of stroke (ischemic, hemorrhagic), affection side (left hemisphere, right hemisphere), pattern of speech (dysarthria, receptive aphasia, expressive dysphasia) and consistency of diet (liquid, semisolid).

Part C: Oral motor structure assessment and reflexes: This part was developed by **(Kumar, Selim. and Caplan 2010) and Kim** (2015) and modified by the researchers to assess the oral motor structure and reflexes related to swallowing before implementing swallowing training rehabilitation program. This part include 11 items: lips which consisted of (four items), tongue (three items) and jaw (one item), complete swallowing reflex, intact gag reflex and effective voluntary cough before implementing swallowing training rehabilitation program.

Tool 2: Dysphagia severity scale

This scale was originally developed in 1993 in Japan by a single specialist rehabilitation team for swallowing disorders then modified and tested for reliability and validity by **(Kunieda et al, 2013)**. It was used by the researchers to assess the level of dysphagia severity following cerebrovascular stroke. The scale included four categories of dysphagia ranged from severe dysphagia to no dysphagia with ten levels under these categories. The first category was no oral intake (severe dysphagia) from (level 1 to level 3), the second category was oral intake and alternative nutrition (moderate dysphagia) from (level 4 to 6), the third category was oral intake alone (mild dysphagia) from (Level 7 to 9) and the fourth category was swallowing is normal (no dysphagia) level 10. The levels of this scale were as follow:

No oral intake (severe dysphagia)

Level 1: No swallowing training is performed except for oral care.

Level 2: Swallowing training not using food is performed.

Level 3: Swallowing training using a small quantity of food is performed.

Oral intake and alternative nutrition (moderate dysphagia)

Level 4: Easy-to-swallow food less than the quantity of a meal (enjoyment level) is ingested orally.

Level 5: Easy-to-swallow food is orally ingested in one to two meals, but alternative nutrition is also given.

Level 6: The patient is supported primarily by ingestion of easy-to-swallow food in three meals, but alternative nutrition is used as a complement.

Oral intake alone (mild dysphagia)

Level 7: Easy-to-swallow food is orally ingested in three meals. No alternative nutrition is given

Level 8: The patient eats three meals by excluding food that is particularly difficult to swallow.

Level 9: There is no dietary restriction, and the patient ingests three meals orally but medical considerations are given.

Swallowing is normal (no dysphagia)

Level 10: There is no dietary restriction and the patient ingests three meals orally (normal).

Tool (3): Observation checklist to assess swallowing ability during swallow trial:

This tool was adapted from Northwestern Dysphagia Patient Checklist which developed by **Logemann, Veis and Colangelo 1999, updated by Audag et al, 2019** and modified by the researchers. It is a screening procedure for oropharyngeal dysphagia. It was used to assess swallowing ability of different food types and its amount. This tool included six items which were; apraxia of swallow, oral residue, coughing/throat clearing, delayed pharyngeal swallow, reduced laryngeal elevation and multiple swallows per bolus. Each item was rated on a 3-point likert scale (never, sometimes and always).

Method: The study was accomplished according to the following steps:

Approval: An official letter clarifying the purpose of the study was obtained from the Faculty of Nursing, Damanhour University and Alexandria University forwarded to the concerned personnel at Alexandria University Hospital to take their permission to collect data**.**

Tools:

− Tool (I) was adopted then modified by the researchers after extensive review of recent and relevant literature then translated into Arabic language by specialist in English language translation. The translation was refined until agreement was obtained among the researchers. The tool reliability was tested by test- retest method within two weeks interval on 6 patients where, cronbach's alpha test was 0.87.

− Tools (II) was adopted then translated into Arabic language by specialist in English language translation. The translation was refined until agreement was obtained among the researchers. The tool reliability was tested by test- retest method within two weeks interval on 6 patients where, cronbach's alpha test was 0.82

− Tool (III) was adopted then translated into Arabic language by specialist in English language translation.

The translation was refined until agreement was obtained among the researchers and its reliability was assured by inter-rater method the association between the two rater ratings of percentage was estimated using Pearson's correlation. This association was high, where r = 0.95 & p = 0.001.

− The content validity of the tools was tested by a jury of 5 experts in the field of medical surgical nursing and 4 experts in neurology medicine.

Pilot study:

A pilot study was conducted on randomly selected 6 patients with cerebrovascular stroke not included in the actual study to assess the clarity and applicability of the tools and to identify any difficulties that may be faced during the actual study. In addition, the time needed to answer the tools was also estimated. The tools proved to be clear and no modifications were needed.

Booklet preparation

The researchers reviewed the recent medical and nursing knowledge and relevant literature **(Padma et al, 2016, Abd-Allah 2014 and Hines 2016)** then developed a booklet. It contains definition of dysphagia, the levels of food consistency given to the dysphagic patient according to his/her swallowing level, types of food that should be avoided for patients with dysphagia, steps of feeding the dysphagic patients, benefits of shaker exercise (head lifting) and how to perform these exercise. Also it contains illustrative pictures; simple language and attractive presentation were considered during the preparation. The booklet was then reviewed by jury of 5 experts in medical surgical nursing field and 4 experts in neurology medicine. After that the needed modifications were done. 30 booklets were printed and given to each patient in the study group before the beginning of the study.

Collection of data:

● Collection of data consumed 8 months (from the beginning of June 2019 to the end of January 2020) Each patient in the study and control groups was interviewed by the researchers individually and in total privacy to assure confidentiality of information and its utilization only for the purpose of the research. The researchers introduced themselves to the patients and explained the purpose of the study and then oral consent was obtained for participation in the study. During this interview tool I was collected from the patients and pre-assessment of oral motor structures and reflexes was done for both groups to assess the oral motor structure and complete swallowing reflex, gag reflex and voluntary cough reflex it took about 30 minutes. After that tool (II) was used for both groups to assess their severity of dysphagia. It took about 45 minutes.

● Observation checklist to assess swallowing ability during swallow trial was done by the researchers for both groups using tool (III). The researchers bring different types of food to assess swallowing ability as Potatoes, Custard, Biscuit, with Teaspoon of water

● The control group was collected first to avoid contamination data and left for routine hospital care.

● Training session for the study group about shaker exercise was done by interviewing each patient for 20-30 minutes individually and privately. The session includes an overview about stroke and its possible effect on swallowing, definition and benefits of shaker exercise and how to perform this exercise. These

information present in previously prepared booklet.

● During the training session each patient in the study group was taught to perform shaker exercise as follows:

- Ask each patient to choose a comfortable position. As shaker exercises can be performed in the supine and sitting position. The exercises involve the oral motor exercises of the lips, tongue, cheeks and the jaw. It was given in about 30 min. Isometric and isokinetic head lift exercises to look at the toes three times a day while lying. The strategy of this exercise is that contracting the suprahyoid muscles "contributes to the upward and forward movement of the larynx and hyoid bone resulting in the opening of the upper esophageal sphincter.

- After exercise implementation, observation checklist to assess swallowing ability during swallow trial was also filled by the researchers to determine the swallowing ability within 15 min during each observation. The observation performed 3 times (after one week, two weeks and one month).

- Shaker exercise (head lifting exercises) was used for one month. The patient was asked to repeat the exercise to ascertain that they have understood the proper way of performing it.

-The researchers were available in the morning and afternoon shift 3 days per week for one week in parallel.

- Shaker exercise supervision and follow up of patient in the study group was implemented by daily telephone communication. Furthermore, the family members were advised to be present at the side of the patients during each meal and follow the exercise technique for later follow up. After two weeks meetings with the participating patients were held and refreshing exercises, and after one month to encourage patients to do shaker exercise regularly and increased their compliance as the patients were requested to come for follow up after 2 weeks and one month at neuro –psychiatric outpatient clinic. During follow up visits they were instructed to increase the number of exercise gradually according to each patient's ability.

● The control group was also followed up after 2 weeks and one month at neuro –psychiatric outpatient clinic.

● After one week while patients still in hospital and during follow up after two weeks and one month post assessment of severity of dysphagia and observation checklist to assess swallowing ability during swallow trial for both the study and control groups using tools (II & III) were performed.

Ethical Consideration:

Each patient in both groups was interviewed alone in privacy to explain the purpose of the study, take his/her oral informed consent to participate in the study. The confidentiality and anonymity of patients' responses were assured; volunteer participation and the right to refuse to participate in the study were emphasized to the patients. Also their right to withdraw from the study was ensured at any time.

Statistical Analysis:

After collection of data, data were fed to the computer and analyzed using IBM Statistical Package for Social Sciences (SPSS) version 20. (Armonk, NY: IBM Corp). Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution.

Quantitative data were described using range (minimum and maximum. Significance of the obtained results was judged at the 5% level.

The used tests were

1 - Chi-square test

For categorical variables to compare between different groups

2 - Fisher's Exact or Monte Carlo correction

Correction for chi-square when more than 20% of the cells have expected count less than 5

3 - Student t-test

For normally distributed quantitative variables to compare between two studied groups

4 - Friedman test

For abnormally distributed quantitative variables, to compare between more than two periods or stages and **Post Hoc Test** (**Dunn**'s**)** for pairwise comparisons.

Results

Table (1 a): Showed that, regarding gender more than half (60.0%, 63.3%) respectively were males in the study group and control group. Regarding age more than three fifths (63.3%) of the study group and more than half (53.3%) of the control group were more than 50 years old. As regards to educational level two fifths of the patients have (40.0%) have completed their primary education in the both groups. As for occupation, it was noticed that 70% and 63.3% of the study and control group respectively were working. There were no statistical significant differences between all demographic characteristics of the patients in the study and control groups.

Table (1 b): showed that, 70% and 60% of the study and control groups respectively didn't have previous cerebrovascular stroke. As for type of stroke, the majority (86.7% and 83.3% respectively) of the study and control groups had ischemic stroke. Regarding to the side of affection, three quarters (75.0%) of the study group and more than three quarters (76.2%) of the control group had right hemisphere affection. Regarding to the pattern of speech, two thirds (40.0%) of the study group and more than half (53.3%) of the control group had dysarthria. 53.3% and 76.7% of the study and control groups respectively had semisolid diet. There were no statistical significant differences in relation to all medical data between patients in the study and control groups.

Table (1 c): Shows that, more than half (56.7%) of the study group and more than three fifths (63.3%) of the control group didn't have complete swallowing reflex. Regarding to gag reflex more than half (53.3%) of the study group and less than half (46.7%) of the control group had intact gag reflex. 86.7% and 70.0% had effective voluntary cough in the study and control group respectively. There were no statistical significant differences between both the study and control groups regarding assessment of oral motor structures and reflexes before swallowing training rehabilitation program including lips symmetrical, lateral stretching, complete closure, tight seal, tongue movement, jaw movement, complete swallowing reflex, gag reflexes and voluntary cough reflex

Table (2): Showed that; 26.7% of the study group and 40.0% of the control group had severe dysphagia (level 1). While, the lowest percent (10.0% and 3.3) of the study and the control groups respectively had mild dysphagia (level 9). There was no statistical significant level between the study and control groups in all dysphagia levels before and one week after swallowing training program. Regarding the severity of dysphagia after 2 weeks and after one month of swallowing training program in the study group the percent decrease to 20.0% and 13.3% respectively in severe dysphagia (level 1). Whereas, the percent increase from 3.3 % after 2 weeks to 23.3% after one months in mild dysphagia (level 10) in the same group. Whilst, the percent of severe dysphagia (level 1) increase in the control group from 40% after 2 week to 66.7% after one months.

There was a statistical significant difference between the study group and the control group after 2 weeks of swallowing training program in dysphagia severity level 5 and level 7 with ($p=0.024^{*}$ and 0.001^{*}) respectively. There was a statistical significant difference between the study group and the control group after one month of swallowing training program in dysphagia severity level 1 where with ($p= 0.001^{*}$).

Table (3): Showed that 43.3% of the patients in the study group always had apraxia of swallow before swallowing training program whilst, 90.0% didn't have it after 1 month of swallowing training program, 36.7 % and 53.3% of patients always had apraxia of swallow in the first assessment and after 1 month respectively in the control group. There was a statistically significant difference between the study group and the control group after 2 weeks and after1 month of swallowing training program with (p= <0.001*). In the study group 30.0% of patients always had Oral residue before swallowing training program and after 1 month of swallowing training program 86.7% of them didn't have it. 43.3% and 53.3% always had Oral residue in the first assessment and after 1 month respectively in the control group. There is a statistically significant difference between the study group and the control after 1 month of swallowing training program (p= <0.001*).

As for coughing and throat clearing, 76.7% of patients always had it before swallowing training program while, after 1 month after implementation of the swallowing training program, 86.7 % didn't have it among the study group. In the control group 56.7 % and 43.3% of patients always had coughing and throat clearing in the first assessment and after 1 month respectively. There was a statistically significant difference between the study group and the control group after 2 weeks and after1 month of swallowing program with (p= <0.003* and <0.004* respectively). Concerning delayed pharyngeal swallow 46.7% of patients always had it before swallowing training program where, 76.7% didn't have it after 1 month of the swallowing training program implementation in the study group. There was a statistically significant difference between the study group and the control after1 month of swallowing training program with (p= <0.045*).

Concerning reduced laryngeal elevation, the majority of patients in both groups never had reduced laryngeal elevation pre- and post-swallowing training program. In relation to Multiple swallows per bolus, 36.7% of patients always had it before swallowing training program while, 66.7% of them didn't have it after 1 month of the swallowing training program implementation in the study group,. 33.3 % and 30.0% of patients always had multiple swallows per bolus in the first assessment and after 1 month respectively in the control group. There was no statistical significant difference between the both groups regarding reduced laryngeal elevation and multiple swallows per bolus. As for, there was a significant difference between the study group after 2 weeks and 1month the

difference was statistically significant in apraxia of swallow with (p= 0.009* and 0.001*) and oral residue with (p= 0.049*and 0.041*) while, the differences were statistically significant after 1 month in coughing and throat clearing, delayed pharyngeal swallow and multiple swallows per bolus with (p= <0.001*, 0.016*and 0.049*) respectively in the same group. Whereas, there were no statistical significant differences among the control group.

Table (1 a): Number and percentage distribution of study subjects according to their demographic characteristics

Demographic Characteristics	Study (n = 30) No.	%	Control (n = 30) No.	%	Test of Sig.	p
Gender						
● Male	18	60.0	19	63.3	χ^2= 0.071	1.000
● Female	12	40.0	11	36.7		
Age per year						
● < 30	2	6.7	3	10.0		
● 30 - < 40	3	10.0	3	10.0	χ^2=	MCp=
● 40 – < 50	6	20.0	8	26.7	0.907	0.896
● 50 +	19	63.3	16	53.3		
Min. – Max.	25.0 – 87.0		18.0 – 87.0		t=	0.382
Mean ± SD.	53.83 ± 14.72		50.43 ± 15.19		0.880	
Educational level						
● Illiterate	8	26.7	7	23.3		
● Primary	12	40.0	12	40.0	χ^2=	MCp=
● Secondary	3	10.0	4	13.4	0.340	1.000
● High education	7	23.3	7	23.3		
Occupation						
● Work	21	70.0	19	63.3	χ^2=	0.584
● Not working	9	30.0	11	36.7	0.300	

χ^2: **Chi square test** MC: **Monte Carlo** **t: Student t-test** p: p value for comparing between the studied groups

Table (1 b): **Number and percentage distribution of study subjects according to their medical data**

Medical Data	Study (n = 30) No	%	Control (n = 30) No	%	Test of Sig.	P
Previous CVS						
● Yes	9	30.0	12	40.0	χ^2=	0.417
● No	21	70.0	18	60.0	0.659	
Type of stroke						
● Ischemic	26	86.7	25	83.3	χ^2=	0.781
● Hemorrhagic	4	13.3	5	16.7	0.077	
Side of affection	**(n = 20)**		**(n = 21)**			
● Right hemisphere	15	75.0	16	76.2	χ^2=	FEp=
● Left hemisphere	5	25.0	5	23.8	0.008	1.000
Pattern of speech						
● Dysarthria	12	40.0	16	53.3		
● Receptive aphasia	10	33.3	11	36.7	χ^2= 2.892	0.236
● Expressive aphasia	8	26.7	3	10.0		

Consistency of diet						
● Liquid	14	46.7	7	23.3	χ^2=	0.058
● Semisolid	16	53.3	23	76.7	3.590	

χ^2: Chi square test- FE: Fisher Exact- p: p value for comparing between the studied groups

Table (1 c): Frequency distribution and significance differences regarding assessment of oral motor structures and reflexes before swallowing training rehabilitation program among the study and control groups of patients with cerebrovascular stroke

Assessment of oral motor structures and reflexes	Study group (n = 30) No.	%	Control group (n = 30) No.	%	χ^2	p
Lips symmetrical rounded						
● Yes	26	86.7	24	80.0	2.455	0.117
● No	4	13.3	6	20.0		
Lateral stretching						
● Yes	19	63.3	22	73.3	1.684	0.194
● No	11	36.7	8	26.7		
Complete closure of lips						
● Yes	24	80.0	12	40.0	2.857	0.091
● No	6	20.0	18	60.0		
Tight seal						
● Yes	18	60.0	20	66.7	1.002	0.317
● No	12	40.0	10	33.3		
Tongue symmetrical movement outside to both sides						
● Yes	22	73.3	23	76.7	1.200	0.273
● No	8	26.7	7	23.3		
Movement downward toward the chin						
● Yes	19	63.3	18	60.0	3.068	0.080
● No	11	36.7	12	40.0		
Elevation of tongue to the upper teeth						
● Yes	24	80.0	22	73.3	1.176	^{FE}p=
● No	6	20.0	8	26.7		0.472
Jaw symmetrical movement to both sides						
● Yes	24	80.0	19	63.3	2.052	0.152
● No	6	20.0	11	36.7		
Complete swallowing reflex						
● Yes	13	43.3	11	36.7	0.278	0.598
● No	17	56.7	19	63.3		
Intact gag reflex						
● Yes	16	53.3	14	46.7	0.267	0.606
● No	14	46.7	16	53.3		
Effective voluntary cough						
● Yes	26	86.7	21	70.0	2.455	0.117
● no	4	13.3	9	30.0		

χ^2: Chi square test - FE: Fisher Exact-p: p value for comparing between the studied groups

Table (2): Frequency distribution and significance of differences according to severity of dysphagia among the study and control groups of patients with cerebrovascular stroke

Dysphagia severity level	Study (n = 30)								Control (n = 30)								$\chi^2(p_1)$	$\chi^2(p_2)$	$\chi^2(p_3)$	$\chi^2(p_4)$
	Pre		1week		2 Week		month		Pre		1week		2 Week		month					
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%				
No oral intake (severe dysphagia)																				
Level 1: No swallowing training is performed except for oral care.	8	26.8	8	26.8	6	20.1	4	13.3	12	40.0	12	40.0	12	40.0	20	66.7	1.200 (0.273)	1.200 (0.273)	2.857 (0.091)	17.778* (<0.001*)
Level 2: Swallowing training not using food is performed.	1	3.0	1	3.0	2	6.8	3	10.0	0	0.0	0	0.0	0	0.0	3	10.0	1.017 (FEp=1.000)	1.017 (FEp=1.000)	2.069 (FEp=0.492)	0.0 (FEp 1.000)
Level 3: Swallowing training using a small quantity of food is performed.	6	20.1	6	20.1	6	20.1	2	6.7	2	6.7	2	6.7	2	6.7	4	13.4	2.308 (FEp=0.254)	2.308 (FEp=0.254)	2.308 (FEp=0.254)	0.741 (FEp=0.671
Oral intake and alternative nutrition (moderate dysphagia)																				
Level 4: Easy-to-swallow food less than the quantity of a meal (enjoyment level) is ingested orally.	3	10.0	3	10.0	2	6.8	4	13.3	0	0.0	0	0.0	0	0.0	1	3.3	3.158 (FEp=0.237)	3.158 (FEp=0.237)	2.069 (FEp=0.492)	1.964 (FEp=0.353
Level 5: Easy-to-swallow food is orally ingested in one to two meals, but alternative nutrition is also given.	4	13.4	4	13.4	6	20.1	2	6.7	0	0.0	0	0.0	0	0.0	0	0.0	4.286 (FEp=0.112)	4.286 (FEp=0.112)	6.667* (FEp=0.024*)	2.069 (FEp=0.492
Level 6: The patient is supported primarily by ingestion of easy-to-swallow food in three meals, but alternative nutrition is used as a complement.	2	6.7	2	6.7	0	0.0	5	16.7	5	16.7	0	0.0	0	0.0	0	0.0	1.456 (FEp=0.424)	2.069 (FEp=0.492)	–	5.455 (FEp=0.052
Oral intake alone (mild dysphagia)																				
Level 7: Easy-to-swallow food is orally ingested in three meals. No alternative nutrition is given	0	0.0	0	0.0	0	0.0	0	0.0	4	13.3	10	33.3	10	33.3	1	3.3	4.286 (FEp=0.112)	5.12.0 (0.050)	12.0* (0.001*)	1.017 (FEp=1.000
Level 8: The patient eats three meals by excluding food that is particularly difficult to swallow.	2	6.7	2	6.7	2	6.8	2	6.7	6	20.0	6	20.0	6	20.0	1	3.3	2.308 (FEp=0.254)	2.308 (FEp=0.254)	2.308 (FEp=0.254)	0.351 (FEp=1.000
Level 9: There is no dietary restriction, and the patient ingests three meals orally, but medical considerations are given.	3	10.0	3	10.0	5	16.7	1	3.3	1	3.3	0	0.0	0	0.0	0	0.0	1.071 (FEp=0.612)	3.158 (FEp=0.237)	5.455 (FEp=0.05	1.017 (FEp=1.00
Level 10 (no dysphagia) : There is no dietary restriction, and the patient ingests three meals orally (normal).	1	3.3	1	3.3	1	3.3	7	23.3	0	0.0	0	0.0	0	0.0	0	0.0	1.017 (FEp=1.000)	1.017 (FEp=1.000)	1.017 (FEp=1.000)	7.925* (FEp=0.01

χ^2: Chi square test - FE: Fisher Exact - *: Statistically significant at $p \leq 0.05$ -p_1: p value for comparing between the study and the control groups in **pre** period, p2: p value for comparing between the study and the control groups after one week period- p3: p value for comparing between the study and the control groups after 2weeks period, p4: p value for comparing between the study and the control groups after 1 month period

Table (3): Frequency distribution and significance differences according to swallowing ability during swallow trial among the study and control groups before and after swallowing training rehabilitation program of patients with cerebrovascular stroke

swallowing ability during swallow trial	Study (n = 30)								Control (n = 30)								$\chi^2(p_1)$	$\chi^2(p_2)$	$\chi^2(p_3)$	$\chi^2(p_4)$
	Pre		1week		2 Weeks		month		Pre		1 week		2 Weeks		month					
	No.	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%				
Apraxia of swallow																				19.200 (<0.001*)
Never	12	40.0	12	40.0	23	76.7	27	90.0	17	56.7	16	53.3	16	53.3	12	40.0	3.270 (0.071)	3.270 (0.071)	3.068 (0.080)	
Sometimes	5	16.7	6	20.0	2	6.6	1	3.3	2	6.6	3	10.0	2	6.7	2	6.7				
Always	13	43.3	12	40.0	5	16.7	2	6.7	11	36.7	11	36.7	12	40.0	16	53.3				
p_0			1.000		0.009*		0.001*				1.000		1.000		0.162					
Oral residue																				
Never	19	63.3	20	66.7	26	86.7	26	86.7	16	53.3	13	43.3	16	53.3	11	36.7	1.763 (0.184)	1.763 (0.184)	12.273* (<0.001*)	20.317* (<0.001*)
Sometimes	2	6.7	2	6.6	2	6.7	3	10.0	1	3.3	3	10.0	2	6.7	3	10.0				
Always	9	30.0	8	26.7	2	6.7	1	3.3	13	43.4	14	46.7	12	40.0	16	53.3				
p_0			1.000		0.049*		0.041*				0.609		0.892		0.549					
Coughing/throat clearing	5	16.7																		
Never			20.0	9	30.0	26	86.7	5	16.7	6	20.0	7	23.3	10	33.3		2.311 (0.131)	3.300 (0.069)	8.531* (0.003*)	8.523 (0.004*)
Sometimes	2	6.6	3	10.0	2	6.7	1	3.3	8	26.6	5	16.7	6	20.0	7	23.3				
Always	23	76.7	21	70.0	19	63.3	3	10.0	`17	56.7	19	63.3	17	56.7	13	43.4				
p_0			1.000		0.124		<0.001*				0.689		0.741		0.498					
Delayed pharyngeal swallow -	13	43.3	13	43.3	15	50.0	23	76.7	16	53.3	16	53.3	16	53.3	14	46.7		2.411 (0.121)	2.411 (0.121)	0.000 (1.000)	4.022* (0.045*)
Never	3	10.0	4	13.4	4	13.3	2	6.6	3	10.0	3	10.0	3	10.0	4	13.3				
Sometimes	14	46.7	13	43.3	11	36.7	5	16.7	11	36.7	11	36.7	11	36.7	12	40.0				
Always																				
p_0			1.000		0.230		0.016*				–		–		–					
Reduced laryngeal elevation	23	76.7	23	76.7	26	86.7	26	86.7	26	86.7	25	83.3	25	83.3	24	80.0				
Never	2	6.6	3	10.0	2	6.7	2	6.6	1	3.3	2	6.7	2	6.7	3	10.0	FE p=0.052	FE p=0.052	FE p=0.353	FE p=1.000
Sometimes	5	16.7	4	13.3	2	6.7	2	6.7	3	10.0	3	10.0	3	10.0	3	10.0	5.192	5.192	1.964	0.000
Always																				
p_0			1.000		0.549		0.549				1.000		1.000		0.549					
Multiple swallows per bolus	12	40.0	13	43.3	16	53.3	20	66.7	15	50.0	15	50.0	15	50.0	16	53.3				
Never	7	23.3	6	20.0	5	16.7	3	10.0	5	16.7	4	13.3	5	16.7	5	16.7	2.168 (0.381)	0.028 (0.854)	2.443 (0.118)	3.977 (0.078)
Sometimes	11	36.7	11	36.7	9	30.0	7	23.3	10	33.3	11	36.7	10	33.3	9	30.0				
Always																				
p_0			1.000		0.068		0.049*				–		–		–					

χ^2: Chi square test - FE: Fisher Exact -*: Statistically significant at $p \leq 0.05$ - p_0: p value for Post Hoc Test (Dunn's) for Friedman test for comparing between pre period and each other period

p_1: p value for comparing between the study and the control groups in pre period, p_2: p value for comparing between the study and the control groups after one week period

p_3: p value for comparing between the study and the control groups after 2weeks period, p_4: p value for comparing between the study and the control groups after 1 month period,

Discussion

Dysphagia is frequent and present alarming symptom that needs urgent attention in patients with stroke. Early screening of dysphagia is essential to prevent future health complications and should have a high priority in the health-care practices. Nurses should be aware of the signs and symptoms of dysphagia to be able to recognize those patients with dysphagia. (**Tanton, 2010)** The mechanism of swallowing is complicated and requires coordination of multiple muscles in the mouth, pharynx, larynx and esophagus through complex sensory information. If the swallowing-related nerves are injured after the incidence of stroke, swallowing disorder is occurred. Stroke is the leading cause of dysphagia, which is paralysis of the throat muscles. This condition can disrupt the swallowing process and make eating, drinking, taking medicine and breathing difficult. **(Duarte, 2013)** The most common treatment for dysphagia is swallowing training program which includes compensatory exercises. In patient with stroke, swallowing exercises helps to compensate and make swallowing safer and to modify food textures to make food easier to manage. Thus, swallowing exercises was believed to decrease dysphagia severity and improve the swallowing ability of patients with dysphagia **(Lazarus et al.; 2014).**

The results of the present study revealed that there were no statistically significant differences between patients demographic characteristics and clinical data between the study and control groups which included age, sex, level of education, occupation, type of stroke, side of affection, pattern of speech, consistency of diet, assessment of oral motor structures, complete swallowing reflex, gag reflexes and voluntary cough reflex. These findings roll out the extraneous factors that might confuse the effect of swallowing training program on dysphagia severity and swallowing ability. These findings were in line with **(Ebrahiem, 2018)** who found in her study (Effect of swallowing training program on dysphagia following cerebrovascular stroke) that most of the studied patients were men and were above 60 years old. On the other hand, increased prevalence of stroke with advanced age results in a high prevalence of dysphagia **(Hinkle and Cheever, 2014).** Also, this finding in the same line with **Paik and Wolff (2017)**, who found in their study (Dysphagia management strategies), that the most common type of stroke was ischemic stroke accompanied with dysphagia.

In the present study no significant difference between both groups in the severity of all dysphagia levels before swallowing training program. This may be attributed to the fact that patients on both groups are relatively similar due to type of stroke, side of affection, pattern of speech, consistency of diet, assessment of oral motor structures, swallowing, gag reflexes or voluntary cough. Moreover, patients' highest percentage in both groups had severe dysphagia. The result of the present study is in the line with the study conducted by **(Takizawa et al,. 2016)** who studied dysphagia bedside screening for acute-stroke patients and stated that Up to 80% of patients develop dysphagia after a stroke.

The present study revealed that, there was no statistical significant difference between the study and control groups in all dysphagia levels after one week of swallowing training program. These findings denote that daily exercises for one week are not enough to reach to the subtle and cumulative effect of Shaker exercises to decrease dysphagia level, so this study conducted for one month to

assess the effect of the exercises. The current study findings are supported by Susan and Jessica 2015 in their study revealed that the Shaker Head Lift in which a combination of an isometric and isokinetic exercise were done, didn't have favorable effects after one week and need more time to strength the suprahyoid muscles and to increase the opening of the upper oesophageal sphincter in patients with dysphagia.

In the present study it was observed that, the severity of dysphagia had significantly decreases to lowest level (level 1) after the implementation of swallowing training program by two weeks and one moth among the study group. At the same time, such decrease was not found among the control group after the implementation of routine hospital care. Also the finding of the present study revealed that, there are significant differences between the study group and the control group after 2 weeks of swallowing training program regarding dysphagia severity level 5and level 7. This result suggests a possible positive effect of shaker exercise on treating dysphagia among patients with stoke. This result may be attributed to the fact that, shaker exercise enhances the contraction of the thyrohyoid muscle, strengthens the suprahyoid muscles, facilitates the upward and forward movement of the larynx and thereby opens the upper esophageal sphincter (UES). **(Antunes and Lunet 2013)** Moreover, it improves both the infrahyoid and suprahyoid muscular activity and reduces pyriform sinus residue and backflow aspiration and restores facilitates oesphysiologic changes in the suprahyoid muscles due to its close proximity with the pharyngeal muscle **(Logemann et al,. 2011).**

The results of the current study is also similar to the results of **(Chulay and Suzanne 2010, and Carr and Shepherd 2012)** who found that return of swallowing to normal level after dysphagic stroke is associated with educating patients and family about how to use the compensatory postures and how to perform oral motor exercises. Regarding compensatory postures, they maximize safe swallowing and minimize the risk and symptoms of aspiration by controlling the direction and the speed of bolus flow through the mouth and the pharynx. Also, the exercises of the lips, tongue, jaw and cheeks increase the strength, coordination and range of motion of labial, lingual and mandibular musculatures **(Hinkle and Cheever, 2014; Grodner, Long and Deyoung, 2017).**

Also the results after this study are in accordance with (**Kang et al,. 2012)** who stated that, bedside exercise program which showed an improvement in dysphagia severity also a positive secondary effect showed improvement in mood state and quality of life of patients with acute stroke. Also the results of the present study agree with the results of **(Robbins et al., 2016)** who found that, four weeks exercise decrease dysphagia severity in patients with stoke.

The result of the present study also revealed that, apraxia of swallow was improved after implementation of the swallowing program after 1 month among the study group. At the same time apraxia of swallow was increased among the control group after the implementation of routine hospital care for 1 month. Oral residue always affect both the study and control groups before swallowing training program but after implementation of swallowing training program for one month in the study group most of the patients improved while, in the control group oral residue increased after one month by the routine hospital care .

In the present study it was observed that most of study group always have coughing and throat clearing before swallowing training program while after one month of implementation of the swallowing training program most of the patients improved. But in the control group most of the patients always had coughing and throat clearing in the first assessment and after 1 month of routine hospital care. Less than half of study group always had delayed pharyngeal swallow before swallowing training program but most of them improved after 1 month of swallowing training program. These results may be attributed to the shaker exercise as, it significantly decreased aspiration, reduced the pyriform fossa residue and so forth would aid in the pharyngeal peristalsis due to the improvement in the suprahyoid muscles **(Basiri, Vali, & Agah, 2017)**

These findings are in line with **(Elfetoh & Karaly, 2018**) who found that many patients had multiple swallow with biscuits due to delaying of oropharyngeal reflex and only few patients had drooling resulting from poor muscle tone around the lips but after implementing of the swallowing training program, the results showed that more than half of the studied patients had an improvement in their swallowing level regarding different food consistencies. Also these findings were supported by **Joundi (2017)** who reported in his study about the rehabilitation program which include positioning, oral motor range of motion exercises and adjusting bolus consistency for patients suffering from dysphagia following acute ischemic stroke to normal swallow (level 7 at the swallowing rating scale).

Finally, the findings of this study clarify the fact that shaker exercises can be used to improve the swallowing ability among patients with cerebrovascular stroke, that can be achieved through educating those patients and their families members how to increase safety of swallowing and contributing in preventing complications related to dysphagia.

Conclusion

In the light of the present study results, it can be concluded that H1 is accepted while, H0 is rejected where patients with cerebrovascular stroke who receive swallowing training program exhibit less severity of dysphagia than those who don't receive it. Swallowing exercises has significant positive effect on severity of dysphagia and improvement in swallowing ability among patients with cerebrovascular stroke.

Recommendation

Based on the findings of the study, the researcher proposed the following recommendations

1. In service training programs for nurses work in the neurological units about assessment of dysphagic patients, the compensatory postures and oral motor exercises for dysphagic patients
2. Establish a multidisciplinary team for dysphagia management including a nurse, speech–language pathologist, dietician and a neurologist.
3. Periodic health education programs for nurses to create awareness on swallowing exercises in improving swallowing ability.
4. The developed booklet with its simple instructions and illustrations should be utilized in hospitals as a teaching aid for patient with dysphagia.
5. Replication of the present study under different circumstances

(sampling, setting, measurement, duration of management) is recommended to validate its results.

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Conflict of interest

No

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