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Original Research Article

Effect of Shaker Exercise and Masako Maneuver on Swallowing Function and Quality of Life in Patients with Dysphagia following Stroke: An Interventional Comparative Study

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ABSTRACT

Background: Dysphagia is a condition that affects the normal deglutition leading to difficulty in swallowing food and liquid. It is a common problem in stroke survivors. Dysphagia after stroke can cause various complications, especially aspiration pneumonia, which can be life-threatening. Some rehabilitation methods reduce the severity of swallowing, improve quality of life, reduce the L-tube intubation period, and reduce the hospital stay duration in patients with dysphagia after stroke. The study compares the effect of the Shaker exercise with conventional therapy and the Masako maneuver with conventional therapy on post-stroke dysphagia. Some studies show the individual effectiveness of the shaker exercise and the Masako maneuver in post-stroke patients. Hence the need arises to evaluate the effectiveness of the Masako maneuver and Shaker exercises in post-stroke dysphagia patients.

Aim: To study the effects of the Shaker exercise with conventional therapy and Masako maneuver with conventional therapy in patients with dysphagia following stroke.

Methodology: convenient sampling was done for the selection of participants. Thirty patients who met the inclusion criteria were recruited from various hospitals in Vadodara. There were 11 men and 19 women among the 30 participants. The patients were divided into two groups. Group 1 received Shaker exercise along with conventional therapy, and Group 2 was received Masako maneuver along with conventional therapy. Baseline data were collected by EAT-10 scale. After 4 weeks, the participants were evaluated again.

Result: The data were analyzed using the paired t-test. During the between-group comparison, group 1 (Shaker Group) showed greater improvement on EAT-10 scale than Group 2 (Masako Group). The SPSS version 23 used for data analysis and the p-value is 0.05.

Conclusion & Clinical Implication: the present study concluded that Shaker exercise along with conventional therapy showed greater improvement in swallowing function and quality of life in patients with post stroke dysphagia. Shaker exercise obtained better results with regards to quality of life and swallowing function than Masako maneuver with conventional therapy.

KEY WORDS: stroke, dysphagia, Shaker Exercise, Masako Maneuver, EAT-10 scale, swallowing, and quality of life.

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INTRODUCTION

Dysphagia is a condition affecting the normal swallowing physiology leading to difficulty in swallowing food and liquid [1].

It is a pervasive and potentially life-threatening condition that can emerge from a number of disturbances affecting sensory, motor, and/or neural systems that underlie swallowing function [2]. Clinical manifestations of dysphagia is the subjective feeling of swallowing stagnation, pain during swallowing, or complete loss of swallowing ability [3].

Normal swallowing consists of four phases: oral phase, oral transfer phase, pharyngeal phase, and esophageal phase. Swallowing is a complex mechanism that involves skeletal muscle (tongue) as well as smooth muscle of the pharynx and oesophagus. Pharyngeal and esophageal phases are coordinated with autonomic nervous system (ANS) [4].

In the oral phase, the mandible depresses and the lips abduct to permit food or liquid to enter the mouth. Once food enters the mouth, the mandible elevates and the lips adduct to help in oral containment of the food and liquid. For swallowing, the formation of the bolus is required during the oral phase [4].

Once the bolus reaches the palatoglossal arch of the oropharynx, the pharyngeal phase begins, which is a reflexive and involuntary phase. Receptors responsible for this are located over the bottom of the tongue, the palatoglossal & palatopharyngeal arches.

In the oral transfer phase, the superior longitudinal muscle is liable for the elevation of the apex of the tongue to form contact with the surface. Therefore, the bolus is propelled to the posterior part of the mouth. Contraction of orbicularis oris abducts the lip and makes a good mouth seal [4]. Tonsillar fossa, uvula, and posterior pharyngeal wall. The swallowing reflex will be initiated entirely by peripheral stimulation of the inner branch of the superior laryngeal nerve. Cranial nerves V (trigeminal), VII (facial), and XII (hypoglossal) are involved in this phase. When the pharyngeal phase begins, other activities like chewing, breathing, coughing, and vomiting are concomitantly inhibited [4].

Dysphagia is classified as oropharyngeal or esophageal, depending on location. In oropharyngeal dysphagia, dysfunction of transfer of food bolus occurs in between the pharynx and upper esophageal sphincter [5]. Esophageal dysphagia occurs due to dysfunctional peristaltic movement or conditions that obstruct the flow of food bolus between the esophagus and stomach. Oropharyngeal dysphagia is most common in older individuals, especially with additional stressors such as acute illness or certain medications. It occurs most often in persons with neurological conditions or skeletal muscle disorders [6]. Oropharyngeal dysphagia is a major disorder following stroke with a high incidence in acute post-stroke patients (37%-78%); it can improve after the first week of the stroke [7].

Dysphagia is usually a common problem following a bulbar or pseudobulbar stroke [3]. Post-stroke dysphagia incidence in India is 11.1%-87.5% [5]. Stroke affects swallowing at multiple levels due to interrupting the feedback loop [3].

Patients with stroke-induced dysphagia ordinarily show diminished function of the oropharyngeal muscles like suprahyoid muscles, that leads to not only oral dysfunction but also aspiration in the pharyngeal phase [1]. Aspiration causes a vicious cough, but a stroke can decrease the sensation of swallowing [2].

Dysphagia following stroke is associated with higher rates of respiratory complications, increased risk of aspiration pneumonia, dehydration, and nutritional compromise [1]. Furthermore, suprahyoid muscle weakness directly affects hyolaryngeal movements, resulting in pharyngeal dysphagia, which can lead to pharyngeal residue and aspiration. Special attention should be given to patients with acute cerebral infarction because there are higher chances of aspiration. It was also reported that one out of three patients surviving acute cerebral infarction has a silent aspiration [8].

The difficulty of swallowing causes medical complications and decreases the quality of life as it affects the most basic human needs and social ties with others [9]. There is frustration

and anxiety in patients who have swallowing problems due to aspiration at mealtime and avoid eating with others. The patient feels a loss of appetite along with depression and social isolation [9].

All this leads to affection on the quality of life and the reduced survival rate of dysphagia patients, associated with an increase in the socio-economic burden due to the frequent need for hospitalization, human burden due to the need of the patients to be attended by the caretakers and psychological burden due to the emotional load and increased dependence of the patients [9].

Although most stroke patients with dysphagia recover by spontaneous resolution and cortical restructuring, approximately 50% of these patients will experience symptoms of dysphagia beyond the rehabilitative period [10]. Treatment improves both the role of swallowing function and the quality of life. Treatment for dysphagia can generally be classified into two categories: compensatory methods and rehabilitative methods. Compensatory methods include modifications, strategies, or maneuvers that provide immediate benefit in swallowing without permanently altering the swallowing physiology. These include techniques like altering food intake methods, modifying the food & fluid viscosity consumed and manipulating head or body position [11].

Rehabilitative approaches, such as isokinetic and isometric contractions of swallowing muscles, are used to reduce the incidence of aspiration. As such, rehabilitative treatments require active participation by the patient. The basic aim of the orofacial physiotherapeutic approach is to strengthen the swallowing musculature (facial, suprahyoid and infrahyoid) to recover its tone, power, movement amplitude, speed and coordination through indirect techniques or direct techniques. This advocates for a shift in practice away from heavy reliance on compensatory food, fluid modifications and positional maneuvers, towards greater use of exercise based, rehabilitative approaches that directly target the underlying swallowing physiology. Rehabilitation approach will lead to reduction in dysphagia related morbidities and improved swallowing function [11].

Swallowing therapy involves a series of exercises. It strengthens the muscles associated with swallowing, which plays an important role in the process of swallowing and target to reduce aspiration. The use of oro-motor exercises within traditional treatment can more focus on increasing sensory awareness and postural changes. Effective treatment of swallowing disorder is important to prevent complications [10,11].

The Masako maneuver and Shaker exercise are swallowing rehabilitation techniques used in swallowing dysfunction following a stroke. Along with traditional therapy, the Masako maneuver and Shaker exercise are frequently used [8].

Shaker exercise is a therapeutic technique for the training of the front neck muscles which are related to swallowing. This exercise includes isotonic and isometric movements. This exercise is done in the supine position with the head rising and looking at the toes [8,9].

There are some literatures indicating that shaker exercise is more effective in improving swallowing capacity in post-stroke dysphagia patients. However, there are some other techniques that are also used to improve swallowing dysfunction.

The Masako maneuver improves the function of pharynx musculature by strengthening the base of the tongue muscles. It has been reported to improve swallowing by improving the coordination of the larynx, hyoid bone, and pharynx. This also reduces airway obstruction during pharyngeal swallowing [6,10].

There are literatures which prove the effects of Shaker exercise and Masako maneuver on the other conditions like head and neck cancer, aspiration pneumonia, tracheostomy, ventilator dependency without neurologic/ structural disturbances. However, there is limited literature showing the effect of the Masako maneuver in post-stroke dysphagia.

Some studies show the effects of shaker exercise and the Masako maneuver individually in post-stroke patients. But there are no

studies on the comparison of Masako and Shaker exercises in post-stroke dysphagia patients. So, this study aims to fill the gap between the literatures.

MATERIALS AND METHODS

All patients diagnosed with dyphagia along with stroke, which were referred by the ENT/ Neurosurgeon/Physician for study, were screened out as per inclusion and exclusion criteria. Patients willing to participate were briefed about the study and written informed consent was taken.

Before intervention and at the end of 4 weeks of intervention, the severity of swallowing function and quality of life of the patients were measured using EAT-10 scale. study was conducted using a EAT-10 scale questionnaire It consists of 10 items. It is used to identify the swallowing function and quality of life of the patient with dysphagia. Two items (Number 2 and 7) assess the impact of dysphagia on a patient's quality of life, and all other specifically investigate the presence and severity of dysphagia. The total score is 0-40. 0 indicates no problem and score 4 is indicates a severe problem. 0 = no problem, 1 = mild problem, 2 = mild to moderate, 3 = moderate problem, 4 = severe problem. Reliability and validity of the EAT-10 scale is confirmed by peter C. Belafsky, et al. (0.72-0.91).

METHODOLOGY

Type of sampling: Convenient and purposive (non-probability) sampling done for this study.

Sample size: sample size was 30 (in each group 15).

Study site: Vadodara, Gujarat, India.

Selection criteria:

INCLUSION CRITERIA:

1) Patient diagnosed with stroke with less than 3 months of onset .

2) Patient with Oropharyngeal dysphagia after stroke conformed by VFSS (videofluoroscopy).

3) Age group between 20-70 years.

4) Those with nasogastric tube.

5) Liquid aspiration or penetration on VFSS((videofluoroscopy).

6) Patient have sufficient, physical and mental ability to understand instruction and cooperate throughout the session, able to communicate properly, those without ant cognitive deficit.(>22 points in the Mini-Mental Status Examination).

EXCLUSION CRITERIA:

1) Pharyngeal surgical procedures of the strap muscles(mylohyoid, geniohyoid, anterior gastric, thyrohyoid muscle.).

2) Patients who could not lift their head and flex the neck.

3) Patients with previous history of stroke.

4) Gastrostomy tube.

5) Those who had undergone tracheostomy.

6) Those with cervical herniated nucleus, cervical spine orthosis.

7) Unstable medical conditions.

Procedure: As shown in the flow chart.

INTERVENTION:

Patients were divided into two groups.

Group 1- Patients received Shaker exercise along with conventional physiotherapy.

Group 2- Patients received Masako maneuver along with conventional physiotherapy.

Conventional therapies for both the groups were as follows:

Supraglottis swallow: Ask the patient to hold their breath tightly (imagine bearing down). Now, tell the patient to swallow their saliva twice, release their breath with a sharp cough, and swallow again.

Compensatory technique: In this technique, the patient will turn their head towards the weak side and tilt it towards the unaffected side then swallow.

Effortful swallow: Patient will swallow as hard as they can with food or saliva. Patient was pushed as hard as they can with the tongue against the roof of their mouth while you swallow.

Oromotor sensory stimulation: It will be given in the form of ice cube massage to areas of the cheek and tongue (at the palatine arch)

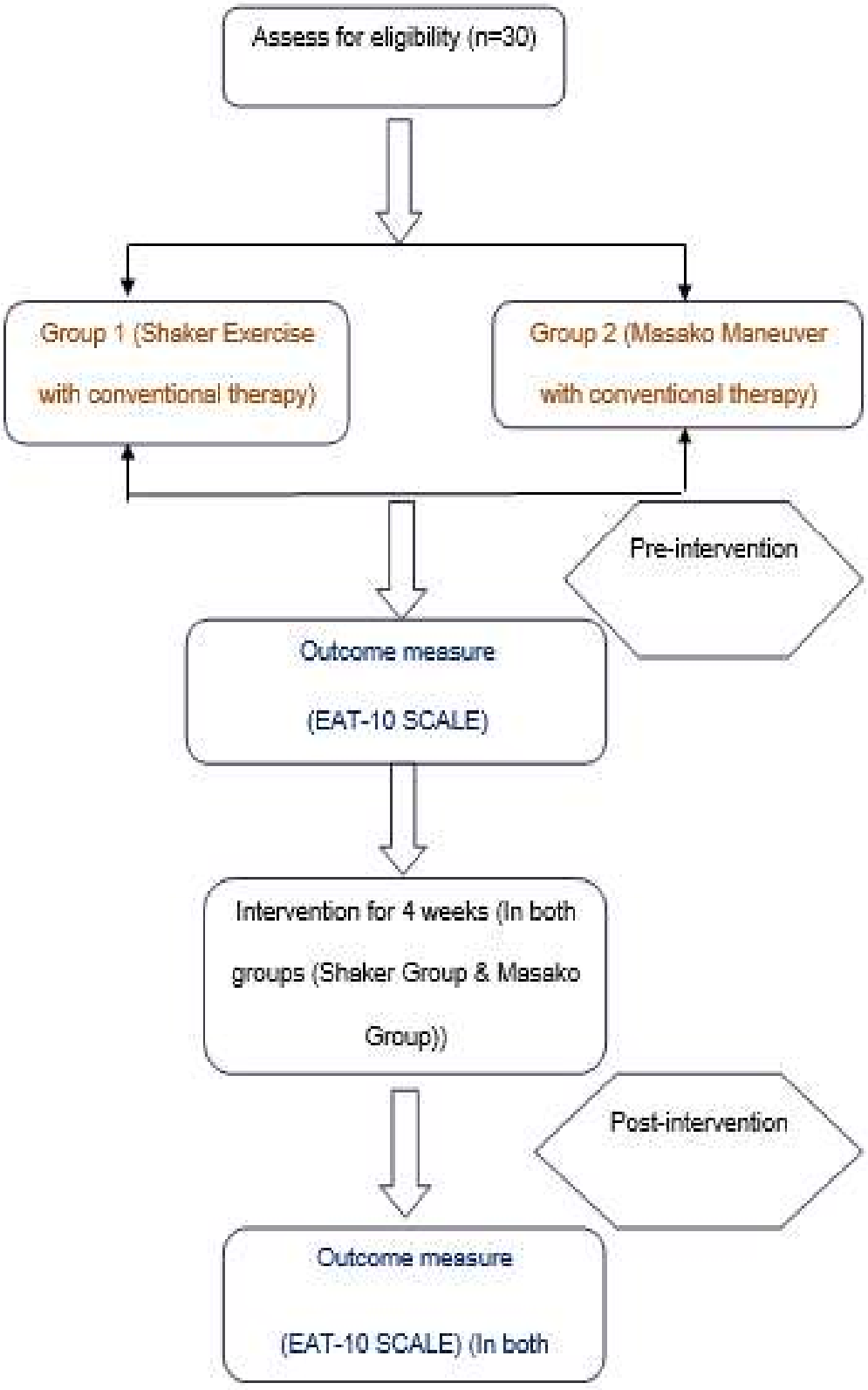


Figure (1): flow chart of study design

and external side of the cheeks. (5 stimulation, 5 swallows).

Conventional therapy was given for 5 min/10 times a day for 4 weeks.

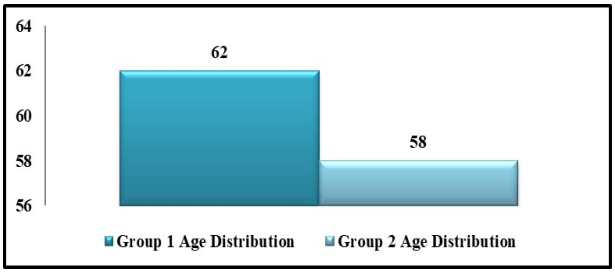
Group 1 was received a shaker exercise along with conventional therapy. In shaker exercise patient was perform isometric and isotonic movements. First, sustained three head lifts held for 60-seconds without movement in a supine position with a 60 seconds of rest between lifts, then, patient performed 30 consecutive repetitions of head lift without holding in the same supine position. For sustained repetitive head rising, patient was instructed to raise the head high enough to be able to observe their toes without raising their shoulders. Shaker exercise was performed for 3 times per day for 10 min, 5 days a week, for 4 weeks.

Group 2 was received a Masako maneuver along with conventional physiotherapy. In Masako maneuver, the patient's position was sitting with proper support in a comfortable or relaxed manner. The exercise was performed by asking the patient to protrude the tongue between the front teeth, holding it in place by gently biting down on the anterior portion of the tongue, and maintain this posture while swallowing saliva, this exercise was performed for 3 sets of 10 repetitions, 3 times per day, 5 days per week, for 4 weeks.

RESULT AND DISCUSSION

Table 1: Age Distribution For Patients In Groups 1 (Shaker Group) and Group 2 (Masako Group).

	GROUP 1 (Shaker Group)		GROUP 2 (Masako Group)	
GROUP	Mean Value	Standard Deviation	Mean Value	Standard Deviation
AGE (YEAR)	62.06	±4.36	58.06	±10.57



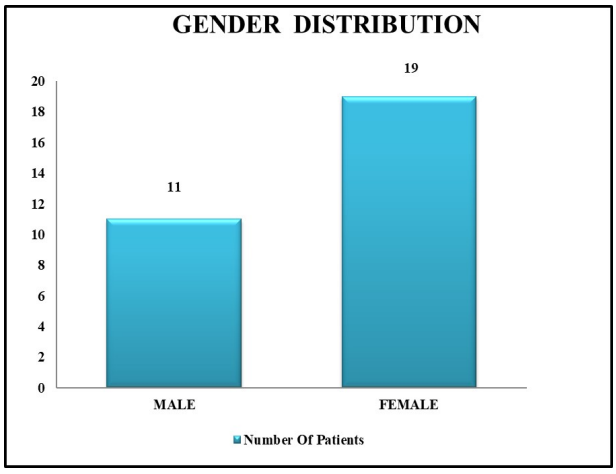
Graph 1: Age Distribution For Patients In Groups 1 (Shaker Group) and Group 2 (Masako Group).

The present study was undertaken to determine the efficiency of Shaker Exercise and Masako Maneuver with conventional therapy on post stroke dysphagia patients. Acute stroke patients are at a high risk of developing dysphagia, which can have a negative impact on their quality of life.[1] This study included 30 post-stroke dysphagia patients diagnosed by an ENT/neurosurgeon/neurophysician. The EAT-10 scale was used before and after the intervention protocol to assess the severity of swallowing and quality of life.

Table 1 shows the mean age of patients in Group 1 was 62.0667 ± 4.36 years, and the mean age in Group 2 was 58.0667 ± 10.57 years. According to B.B. Hamidon et al., [11], swallowing difficulty increases with normal aging owing to structural changes in swallowing that result in decreased swallowing function and average volume per swallowing [11,15]. Patients over the age of 65 years are at risk of having a stroke [20]. Dysphagia is a common complication in stroke patients [9,17,19].

Table 2: Gender Distribution Of The Patients With Dysphagia Followed By Stroke.

GENDER	NUMBER OF PATIENTS
MALE	11
FEMALE	19

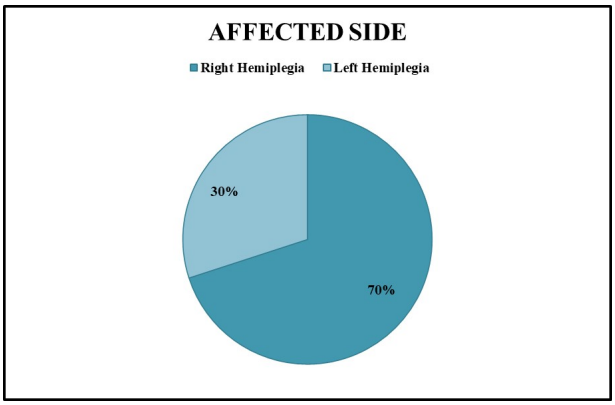


Graph 2: Gender Distribution Of Patients With Dysphagia Followed By Stroke.

Table 2 shows that 19 of the 30 patients were female and 11 were male. The total number of females overtaken the total number of males. However, both genders were equally affected by post-stroke dysphagia [21].

Table 3: Affected Side of the Patients with Dysphagia Followed By Stroke.

AFFECTED SIDE	NO. OF PATIENTS
RIGHT	21
LEFT	9



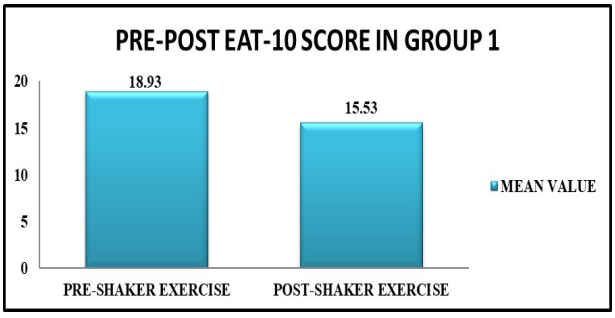
Graph 3: Affected side of the patients with dysphagia followed by stroke.

Table 3 depicts affected side of patients with dysphagia followed by stroke. Out of 30 patients, 21 patients had right side hemiplegia and 9 patients had left hemiplegia. Previous literature suggests that each hemisphere has a different role in swallowing and that left hemisphere lesion are more often associated with oral stage dysfunction while right hemisphere lesions are more often associated with pharyngeal stage dysfunction [12,13].

Table 4: Comparison Of Pre-Post Mean Value For EAT-10 Score Within Group 1 (Shaker Group).

EAT-10 (MASAKO GROUP)	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	t VALUE	p VALUE (p*)
Pre – intervention	14.26	±5.47	1.41	6.95	<0.0001*
Post – intervention	12.13	±5.12	1.32		

p* –value < 0.05 significant, p-value >0.05 non-significant



Graph 4: comparison of Pre-Post Mean Value for EAT-10 score within Group 1 (Shaker Group)

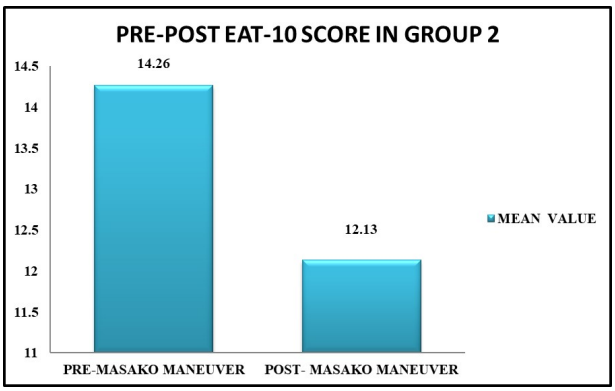
Table 4 compares the mean value for the EAT-10 scale within group 1 (Shaker Group). The mean value of the EAT-10 scale before intervention was 18.93 ± 4.23, and the mean value after intervention was 15.53 ± 4.67. Thus the present study concluded the EAT-10 scale value was reduced after the 4 weeks of intervention, suggesting that Shaker Exercise with conventional therapy provides benefits in post stroke dysphagia patients. Shaker exercise, according to Jong-Bae et al,[9]is effective for activating the suprahyoid muscles, and improves the strength of swallowing muscles with repetition.[9,10] According to the researchers, strong muscle contraction of the suprahyoid muscle results in anterior-superior movement of the hyoid bone, which protects the airway and improves swallowing function [8].

Furthermore, conventional therapy is effective in improving swallowing function and lowering the risk of aspiration. According to some authors, repeated exercise by patients has the potential to increase muscle fiber recruitment, produce more muscle force, and improve swallowing function [2,3,9].

Table 5: Comparison of Pre-Post Mean Value For EAT-10 Score Within Group 2 (Masako group).

EAT-10 (MASAKO GROUP)	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	t VALUE	p VALUE (p*)
Pre – intervention	14.26	±5.47	1.41	6.95	<0.0001*
Post – intervention	12.13	±5.12	1.32		

p* –value < 0.05 significant, p-value > 0.05 non-significant



Graph 5: Comparison Of Pre-Post EAT-10 Score Within Group 2 (Masako Group).

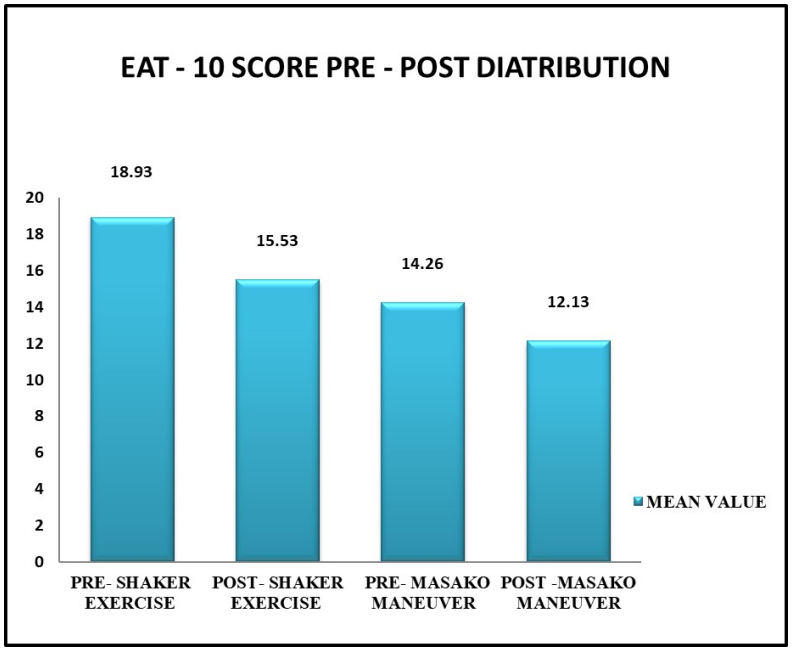
Table 5 compares the mean value of the EAT-10 scale within Group 2 (Masako Group).

Table 6: Comparison Of Pre-Post Mean Value For EAT-10 Score Between Group 1(Shaker Group) and Group 2(Masako Group).

POST INTERVENTION VALUE (EAT-10)	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	t VALUE	p VALUE (p)
Shaker group (GROUP 1)	15.5333	±4.67312	1.2066	1.983	<0.067
Masako group (GROUP 2)	12.1333	±5.12510	1.3233		

p* –value < 0.05 significant, p-value > 0.05 non-significant

Graph 6: Comparison of EAT – 10 Pre- Post score Between Groups (Shaker group & Masako group) Among Patients With Dysphagia Followed By Stroke.



The mean value of the EAT-10 scale before intervention was 14.26 ± 5.47, and the mean value after intervention was 12.13 ± 5.12. As a result, the current study concluded that the EAT-10 scale value was reduced after 4 weeks of intervention, implying that Masako Maneuver combined with conventional therapy shows improvement in post stroke dysphagia patients. According to Haewon Byeon et al, [6] the Masako Maneuver improves tongue muscle strength, activates the central pattern like swallowing reflex, suprahyoid muscle activation, and improves swallowing coordination to protect the airway. Coughing episodes after eating are also reduced, as is the sensation of food stuck in the throat [6,10].

Table 6 shows a comparison of mean values for the EAT-10 scale between group 1 (Shaker Group) and 2. (Masako Group). The mean value of the EAT-10 scale after intervention in group 1 (Shaker Group) was 15.53 ± 4.67, and the mean value of the EAT-10 scale after intervention in group 2 (Masako Group) was 12.13 ± 5.12. So, the current study concludes that the EAT-10 scale value was reduced after 4 weeks of intervention, but group 1 (Shaker Group) shows greater improvement than group 2 (Masako Group), As a result, the current study concludes that both exercises improved swallowing function and quality of life in stroke patients with dysphagia. However, Shaker Exercise with conventional therapy showed more improvement than the Masako Maneuver with conventional therapy in post-stroke dysphagia.

Shaker exercise is a therapeutic method for training the swallowing-related muscles in the front of the neck. It is a strap muscle exercise. This exercise is intended to improve the flexibility and strength of the strap muscle. This head lift exercise is primarily composed of isometric and isokinetic contraction movements. Because of these repetitive movements, the Shaker exercise is effective for activating muscles in front of the neck, improving the anterior and superior movement of the hyoid bone, and contributing to the opening of the upper esophageal sphincter and strength-

ening the muscles. It improves swallowing in patients with swallowing difficulty [8,9].

On the other hand, the Masako maneuver is the base of tongue exercise. The base of the tongue is the "pump" that pushes food through the throat into the esophagus. This exercise is designed to strengthen the base of the tongue. In this exercise, tongue movement plays a major role. The anterior retraction of the tongue can help patients with dysphagia improve their swallowing function. Masako maneuver also improves the constriction of the pharynx and airway obstruction during pharyngeal swallowing [6,10].

Shaker exercise affects the strap muscles responsible for the opening and closing of the upper esophageal sphincter. Masako maneuver strengthens the tongue base musculature, which is related to swallowing function and helps to push the food into the esophagus. Thus, as shaker exercise directly targets the swallowing musculature, it may be more beneficial in improving swallowing function than the Masako maneuver.

CONCLUSION

We aimed in this study to evaluate the effect of the Shaker Exercise along with conventional therapy, and the Masako maneuver along with conventional therapy in patients with dysphagia followed by stroke. A total of 30 patients diagnosed with dysphagia and stroke were screened as per inclusion criteria. The EAT-10 scale was used for each group before and after four weeks of intervention. The data were analyzed, and the result obtained was that Group 1 showed greater improvement on EAT-10 scale score. The study concluded that integrating the Shaker exercise and Masako maneuver with conventional therapy is effective in rehabilitation to improve swallowing function and quality of life in patients with post-stroke dysphagia. Moreover, the Shaker exercise obtained better results along with conventional therapy in swallowing function and quality of life than the Msako maneuver in patients with post-stroke dysphagia.

Further recommendation: The present study acknowledges that future studies are required to understand better the effects of shaker exercise, Masako maneuvers, and conventional therapy in post-stroke dysphagia patients.

For future studies, a large sample size can be taken. A long-term follow-up may be included to determine the intervention protocol's efficacy.

Videofluoroscopy pre and post-intervention can be done, as it is useful for more accurately evaluating swallowing function.

Limitations: The first limitation of this study is the small sample size. A small sample size of 30 participants, 15 in each group (Shaker Group, n=15 and Masako Group, n=15) cannot cover the whole population of dysphagia followed by stroke. Therefore, the results should be interpreted with caution.

Another limitation is that longer follow-up of patients with dysphagia is needed. Thirdly, Video fluoroscopy provides more accurate information about swallowing function, which is not done in the present study.

ABBREVIATION

ENT: Ear, Nose and Throat.
FOIS: Functional Oral Intake Scale.
GUSS: Gugging Swallowing Screening Scale.
IQR: Inter Quartile Range.
MRI: Magnetic Resonance Imaging.
PNF: Proprioceptive Neuromuscular Facilitation.
RT: Ryles Tube.
SFSS: Swallow Function Scoring System.
VDS: Videofluoroscopic Dysphagia Scale
VFSS: Videofluoroscopy.
SD: Standard Deviation.
SPSS: Statistical Package For The Social Sciences.

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Conflicts of interest: **None**

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