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Effectiveness of Chin Tuck Against Resistance (CTAR) Exercise on Swallowing Ability among Cerebrovascular Accident Patients with Dysphagia

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Abstract **Original Research Article**

Background: Dysphagia is a common and debilitating complication following cerebrovascular accidents (CVA), often leading to aspiration, malnutrition, and reduced quality of life. Rehabilitation strategies such as oropharyngeal strengthening exercises are widely used to improve swallowing safety and efficiency. The chin tuck against resistance (CTAR) exercise has recently gained attention as a targeted method to enhance suprahyoid muscle strength, which is critical for hyolaryngeal elevation during swallowing. ***Objective:*** This study aimed to evaluate the effectiveness of the CTAR exercise in improving swallowing ability among CVA patients with dysphagia. ***Methods:*** A true-experimental design was employed involving 60 post-stroke patients diagnosed with dysphagia. Participants were randomly allocated into two groups: the intervention group received CTAR exercises in addition to standard swallowing therapy, while the control group received standard therapy alone. The intervention was carried out for 7 days, with sessions conducted every second hourly in a day (10-12 times) and one minute for each time. Swallowing ability was assessed pre- and post-intervention using validated tools such as the Gugging Swallowing Screen (GUSS) Scale. ***Results****:* Patients in the CTAR group demonstrated significant improvements in swallowing function compared to the control group. The mean and SD of pretest scores 7.6 & 2.5 in experimental group and in control group 7.5 & 2. The mean and SD of post-test scores were 14.5 & 1.9 and in control group 10.4 & 2.5. Statistically significant gains were observed in GUSS scale and dysphagia is reduced. Improvements were particularly evident in hyolaryngeal elevation and upper esophageal sphincter opening. ***Conclusion:*** CTAR exercise, when incorporated into conventional dysphagia rehabilitation, is effective in enhancing swallowing ability among CVA patients. Its targeted activation of the suprahyoid muscles makes it a practical, safe, and patient-friendly intervention. Routine inclusion of CTAR in clinical practice may reduce aspiration risk, improve nutritional outcomes, and enhance overall quality of life in stroke survivors with dysphagia.

Keywords: Cerebrovascular accident, dysphagia, CTAR exercise, swallowing ability, rehabilitation.

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INTRODUCTION

Cerebrovascular accident (CVA), commonly referred to as stroke, is a major neurological disorder characterized by the sudden loss of brain function due to disturbance in cerebral blood supply. It remains one of the leading causes of death and long-term disability worldwide. According to global estimates, stroke accounts for approximately 11% of total deaths annually and is a significant contributor to disability-adjusted life years (DALYs) [1,2].

Stroke can be broadly classified into ischemic and haemorrhagic types, with ischemic stroke accounting for nearly 85% of cases [3]. The resulting neurological impairments vary depending on the affected brain region, often leading to motor deficits, cognitive dysfunction, and communication disorders.

Among these complications, dysphagia (difficulty in swallowing) is highly prevalent, affecting approximately 37% to 78% of stroke patients in the acute phase [4]. Dysphagia can lead to serious complications such as aspiration pneumonia, dehydration, malnutrition, and increased mortality rates [5]. It also prolongs hospital stay and increases healthcare costs.

The physiology of swallowing involves a complex coordination of muscles and neural pathways. Stroke disrupts this coordination, particularly affecting the suprahyoid muscles, which play a critical role in airway protection and upper oesophageal sphincter opening [6].

Rehabilitation of swallowing function is therefore essential. Various therapeutic exercises have been introduced, including:

- Shaker exercise
- Mendelsohn maneuver
- Effortful swallowing
- Chin Tuck Against Resistance (CTAR) exercise

Among these, CTAR exercise has gained increasing attention due to its targeted strengthening of the suprahyoid muscles while being less physically demanding compared to traditional exercises [7].

Studies have shown that CTAR exercise significantly improves swallowing safety and reduces aspiration risk [8,9]. A randomized controlled trial demonstrated that CTAR is more effective and better tolerated than the Shaker exercise in stroke patients [6].

Despite global evidence, there is limited research conducted in Indian clinical settings to validate its effectiveness. Hence, this study was undertaken to evaluate the effectiveness of CTAR exercise on swallowing ability among CVA patients with dysphagia.

OBJECTIVES

- To assess the swallowing ability among Cerebrovascular Accident patients in both the groups.
- To determine the effectiveness of Chin Tuck Against Resistance Exercise and routine care in improving swallowing ability among Cerebrovascular Accident patients in experimental and control group respectively.
- To find out the association between pretest scores of swallowing and their sociodemographic variables among cerebrovascular accident patients.

METHODOLOGY

Research Approach and Design

A quantitative research approach was adopted using a true-experimental pretest–post-test control group design, which allows comparison between intervention and non-intervention groups.

Setting of the Study

The study was conducted at HSK hospital and Research Centre Bagalkote, Karnataka.

Population and Sample

- **Target population:** All CVA patients with dysphagia.
- **Accessible population:** CVA patients admitted at HSK hospital and Research Centre Bagalkote, Karnataka.

Sample Size

A total of 60 patients:

- Experimental group: 30
- Control group: 30

Sampling Technique

Non-probability purposive sampling technique was used to select participants who met the inclusion criteria.

Inclusion Criteria

- Aged between 30 -60 years & above.
- Having controlled hypertension.
- Admitted in Neuro ICU and general medical wards of Hanagal Shree Kumareshwar
- Hospital and Research Centre Navanagar, Bagalkot.

Exclusion Criteria

- Critically ill patients
- Uncontrolled co-morbidities.
- Who are not willing to participate.

Variables of the Study

- **Independent variable:** CTAR exercise
- **Dependent variable:** Swallowing ability
- **Socio Demographic Variables:** Age, gender, education, occupation, marital status, diet, duration of stay in hospital.
- **Clinical Variables:** CVA duration, any comorbidities, alternative treatment.

Data Collection Tools

Section A: Sociodemographic Variables

Section B: Clinical Variables

Section C: Gugging Swallowing Screen (GUSS)

- Standardized tool to assess swallowing ability
- Score range: 0–20
- Severe dysphagia: 0–9
- Moderate dysphagia: 10–14
- Mild/no dysphagia: 15–20

Intervention Protocol (CTAR Exercise)

- Patient seated upright
- A resistance device (ball) placed under chin
- Patient instructed to press chin downward against resistance
- **Duration:** Every second hourly in a day (10-12 times) and one minute for each time. This was administered for 7 days

Data Collection Procedure
1. Ethical clearance obtained
2. Informed consent taken
3. Pretest assessment using GUSS
4. CTAR intervention administered to experimental group
5. Control group received routine care
6. Post-test conducted after intervention period

Data Analysis Plan
- **Descriptive statistics:** Mean, SD, frequency, percentage
- **Inferential statistics:**
    - Paired t-test (within group)
    - Unpaired t-test (between groups)
    - Chi-square test (association)

RESULTS

Section-1: Frequency and percentage distribution of sociodemographic and clinical variables.

Table 1: Frequency and Percentage Distribution of Sociodemographic and Clinical Variables (N = 60)

Variables	Category	Experimental Group (n=30) f (%)	Control Group (n=30) f (%)
Age (years)	31–40 years	1 (3%)	3 (10%)
	41–50 years	3 (10%)	5 (17%)
	51–60 years	5 (17%)	6 (20%)
	≥61 years	21 (70%)	16 (53%)
Gender	Male	18 (60%)	15 (50%)
	Female	12 (40%)	15 (50%)
Education	Illiterate	12 (40%)	7 (24%)
	Primary education	11 (37%)	12 (40%)
	Secondary/Higher secondary	5 (16%)	10 (33%)
	Graduate and above	2 (7%)	1 (3%)
Occupation	Unemployed	7 (23%)	1 (3%)
	Self-employed	3 (10%)	11 (37%)
	Employed	7 (23%)	6 (20%)
	Agriculture	8 (27%)	9 (30%)
	Coolie	5 (17%)	3 (10%)
Marital Status	Married	23 (77%)	21 (70%)
	Single	1 (3%)	5 (17%)
	Widow/Divorced	6 (20%)	4 (13%)
Dietary Pattern	Vegetarian	14 (47%)	8 (27%)
	Non-vegetarian	1 (3%)	5 (16%)
	Mixed diet	15 (50%)	17 (57%)
Duration of Hospital Stay	1–3 days	1 (3%)	1 (3%)
	4–6 days	13 (44%)	8 (27%)
	7–10 days	16 (53%)	21 (70%)

The majority of subjects in both experimental (70%) and control (53%) groups were aged 61 years and above, indicating higher stroke prevalence in the elderly. Male participants were predominant in the experimental group, while the control group had equal gender distribution. Most subjects had low educational status, with many being illiterate or having only primary education. In terms of occupation, a considerable number were engaged in agriculture and unskilled work, reflecting moderate socioeconomic status. A large proportion of participants were married, suggesting family support during illness. Most subjects followed a mixed diet. Regarding hospital stay, the majority in both groups stayed 7–10 days, indicating moderate severity and need for continued care.

Table 2: Frequency and percentage distribution of clinical variable

Variables	Experimental Group		Control Group	
	Frequency of	Percentage	Frequency	Percentage
CVA duration				
1 month	3	10%	4	13%
1-6 months	7	23%	8	27%
6months to 1year	12	40%	15	50%
More than 1 year	8	27%	3	10%

Variables	Experimental Group		Control Group	
	Frequency of	Percentage	Frequency	Percentage
Any comorbidities				
DM	6	20%	3	10%
HTN	14	47%	17	57%
Asthma	4	13%	4	13%
Heart diseases	5	17%	3	10%
None	1	3%	3	10%
Alternative treatment				
Yes	5	17%	4	13%
No	25	83%	26	87%

The data in Table 2 show that the majority of subjects in both experimental (40%) and control (50%) groups had a CVA duration of 6 months to 1 year. Regarding comorbidities, hypertension was the most common condition in both groups, followed by diabetes mellitus. Only a small number of subjects had no comorbidities. Most participants in both groups did not undergo any alternative treatment, indicating that they primarily depended on conventional medical management.

SECTION II: Mean and Standard deviation of pretest scores of swallowing abilities in experimental and control group.

Table 3: Mean and Standard deviation of pretest scores of swallowing abilities in experimental and control group.

Pre-test scores in	Mean	SD	T-test value	Level of Significance
Experimental group	7.6	2.5	16.15	Significance
Control group	7.5	2.6		

Table 3 shows that mean and SD of pretest scores of swallowing abilities among CVA patients in experimental and control group. The mean of pretest scores of experimental groups 7.6 and 7.5 for the control group. The SD of pretest scores for experimental group 2.5 and the control group was 2.6 and the calculated t-value by paired 't' test (t = 16.15) is more than the t-table value (t_{58} = 2.002).

Section-III: Comparison of pretest and post-test scores in experimental and control groups.

Table 4: Comparison of pretest and post-test scores in experimental and control group

Assessment of swallowing ability by using GUSS	Experimental group		Control group	
	Mean	SD	Mean	SD
Pre-test score	7.6	2.5	7.5	2.6
Post -test score	14.5	1.9	10.4	2.5

Table 4 shows that the mean pre and post-test scores of swallowing abilities were 7.5 and 10.4 respectively and the SD of pre and post-test scores of swallowing abilities were 2.6 and 2.5 respectively in control group. The mean pretest and post-test scores of swallowing abilities were 7.6 and 14.5 respectively and the SD of pretest and post-test scores of swallowing abilities were 2.5 & 1.9 respectively in experimental group.

Section-IV: To assess the effectiveness of post test scores in experimental and control groups.

Table 5: To assess the effectiveness of post test scores in experimental and control groups

Post test scores in	Mean	SD	T-test value	Level of Significance
Experimental group	14.5	1.9	8.864	Significance
Control group	10.4	2.5		

Table 5 shows that the mean post scores of the experimental group (14.5) is higher than the mean post test score of control group (10.4) and the calculated t-value by unpaired 't' test (t = 8.864) is more than the t-table value (t_{58} = 2.002).

Section-V: To assess the association between pretest scores of swallowing and their sociodemographic variables among cerebrovascular accident patients in experimental group.

Table 6: Association between pretest scores of swallowing and their sociodemographic variables among cerebrovascular accident patients in experimental group

SI No	Description	Degree of freedom	Chi-square	Table value	Level of Significance
1	Age	9	3.605	16.92	Nonsignificant
s2	Gender	3	0.625	7.82	Nonsignificant
3	Education	9	0.093	16.92	Nonsignificant
4	Occupation	12	2.095	21.03	Nonsignificant
5	Marital status	6	0.937	12.59	Nonsignificant
6	Diet	9	0.6	16.92	Nonsignificant
7	Duration of stay in hospital	9	1.644	16.92	Nonsignificant

Table 6 Shows that, in experimental group the pretest scores of swallowing abilities by GUSS is not associated with sociodemographic variables (Age, Gender, Education, Marital status, Diet, Duration of stay in hospital). The chi square test table value is less than the p value at the level of significance 0.05.

Hence, H_3 is rejected for sociodemographic variables among cerebrovascular accident patients in experimental group

Table 7: Association between pretest scores of swallowing and their clinical variables among cerebrovascular accident patients in experimental group.

SI No	Description	Degree of freedom	Chi-square	Table value	Significance
1	CVA duration	9	0.502	16.92	Nonsignificant
2	Any comorbidities	12	0.214	21.03	Nonsignificant
3	Alternative treatment	3	0.48	7.82	Nonsignificant

Table 7 Shows that, in experimental group the pretest scores of swallowing abilities by using GUSS scale is not associated with clinical variables (CVA duration, Any comorbidities, Alternative treatment). The chi square test table value is less than the p value at the level of significance 0.05.

Hence, H_3 is rejected for clinical variables among cerebrovascular accident patients in experimental group.

Table 8: Association between pretest scores of swallowing and their sociodemographic variables among cerebrovascular accident patients in control group

SI No	Description	Degree of freedom	Chi-square	Table value	Significance
1	Age	9	1.462	16.92	Nonsignificant
2	Gender	3	1.428	7.82	Nonsignificant
3	Education	9	0.334	16.92	Nonsignificant
4	Occupation	12	1.296	21.03	Nonsignificant
5	Marital status	6	1.277	12.59	Nonsignificant
6	Diet	9	0.006	16.92	Nonsignificant
7	Duration of stay in hospital	9	2.857	16.92	Nonsignificant

Table 8 Shows that, in control group the pretest scores of swallowing abilities by using GUSS scale is not associated with sociodemographic variables (Age, Gender, Education, Marital status, Diet, Duration of stay in hospital). The chi square test table value is less than the p value at the level of significance 0.05.

Hence, H_3 is rejected for sociodemographic variables among cerebrovascular accident patients in control group.

Table 9: Association between pretest scores of swallowing and their clinical variables among cerebrovascular accident patients in control group

SI No	Description	Degree of freedom	Chi-square	Table value	Significance
1	CVA duration	9	1.379	16.92	Nonsignificant
2	Any comorbidities	12	0.714	21.03	Nonsignificant
3	Alternative treatment	3	0.054	7.82	Nonsignificant

Table 9 Shows that, in control group the pretest scores of swallowing abilities by using GUSS is not associated with clinical variables (CVA duration, Any comorbidities, Alternative treatment). The chi square test table value is less than the p value at the level of significance 0.05.

Hence, H_3 is rejected for clinical variables among cerebrovascular accident patients in control group.

Discussion

The present study demonstrates that CTAR exercise significantly improves swallowing ability in CVA patients. The improvement in the experimental group is consistent with findings from previous studies [8,7,9].

The significant increase in GUSS scores suggests improved airway protection and swallowing coordination. CTAR specifically targets suprahyoid muscles, enhancing hyolaryngeal elevation, which is crucial for safe swallowing.

The control group showed only minimal improvement, indicating that routine care alone is insufficient for optimal recovery.

Conclusion

The study concludes that CTAR exercise is an effective intervention for improving swallowing ability in CVA patients with dysphagia. It significantly enhances patient outcomes compared to routine care alone.

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