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Comparison Of Rubber Ball Graining Therapy and Constraint Induced Movement Therapy (Cimt) on Improving Muscle Strength in Ischemic Stroke Patients in the Want to be a successful Pukes Center Work Area

Anisa Kamilia Putri[1]
[1]Bachelor's Degree Program in Nursing Science and Professional Nursing Education, Bina Bangsa Getsempena University, Banda Aceh:
Eridha Putra[2]
[2]Bachelor's Degree Programs in Nursing Science and Professional Nursing Education, Bina Bangsa Getsempena University, Banda Aceh
Rehmaita Malem[3]
[3]Bachelor's Degree Programs in Nursing Science and Professional Nursing Education, Bina Bangsa Getsempena University, Banda Aceh
Ully Muzakir[4]
[4]Bachelor's Degree Programs in Nursing Science and Professional Nursing Education, Bina Bangsa Getsempena University, Banda Aceh
Ferdy Riansyah[5]
[5]Bachelor's Degree Programs in Nursing Science and Professional Nursing Education, Bina Bangsa Getsempena University, Banda Aceh

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ABSTRACT
Stroke is a neurological disorder that can cause loss of motor and sensory abilities in some or all of the extremities, both upper and lower. This loss of ability results in obstacles to physical mobility. Stroke patients often experience a significant decrease in independence and become more vulnerable to mental disorders. This study aims to analyze the comparison of rubber ball gripping therapy and constraint-induced movement therapy (CIMT) on increasing muscle strength in ischemic stroke patients. The method used is quantitative research with a quasi-experimental design. The sampling technique used purposive sampling, with a total of 32 respondents. This study was conducted in May and June 2025 using the MMT (manual muscle testing) observation sheet instrument. The results showed that there were significant changes between before and after the implementation of therapy, both in Constraint Induced Movement Therapy (CIMT) and rubber ball gripping therapy. with a significance value of 0.000. Likewise, rubber ball grasping therapy showed a Z value of -3.619 with a significance of 0.000. Thus, it can be concluded that Rubber Ball Grasping Therapy and Constraint Induced Movement Therapy (Cimt) have a significant effect on improving patient motor skills.
Keyword: Ischemic stroke, rubber ball grasping therapy, Constraint Induced Movement Therapy (CIMT), upper extremity muscle strength.

Introduction

Stroke is a neurological disorder that can cause loss of motor and sensory abilities in some or all of the upper and lower extremities. This loss of ability impedes physical mobility. Stroke patients often experience a significant reduction in independence and become more susceptible to mental disorders (Donkor, 2018). Approximately two-thirds of stroke patients experience upper extremity weakness in the acute phase (Brunner et al., 2018). Ischemic stroke is a brain disorder caused by the interruption or obstruction of blood flow due to ischemia, thrombosis, embolism, or narrowing of the lumen. In general, patients experiencing non-hemorrhagic stroke will experience impaired sensory and motor function, which can result in balance problems, muscle weakness, loss of coordination, and disturbances in body balance and posture, including hemiparesis (Wijaya, RFJ, Wardoyo, E., 2024).

According to the World Health Organization (WHO, 2024), 15 million people suffer from stroke each year, of which 5 million die and another 5 million are left disabled. In Nepal, a South Asian country with a population of 29 million, stroke prevalence reports show quite high rates by age, particularly in the Southwest region in 2018, with prevalence rates of 2,368 and 2,967 per 100,000 (Paudel, R., 2023).
Based on the 2018 Basic Health Research (Riskesdas), the prevalence of stroke in Indonesia reached

10.9%, equivalent to 713,783 people. Stroke is the leading cause of death in the country, with a mortality rate of 131.8 per 100,000. The highest stroke prevalence is found in East Kalimantan province, at 14.7%, or 9,696 people (Siagian et al., 2024).

The Aceh Provincial Health Office recorded a high number of stroke sufferers based on the 2022 Non-Communicable Disease Surveillance, indicating a relatively high number of stroke sufferers in Aceh, at 12,303 (Lukman, 2023). According to the 2020 Health Office (Dinkes), Aceh Besar Regency recorded 123 strokes in men and 117 in women in 2021, for a total of 240 sufferers (Cut Nazma Cassrisa, nd).

Previous research by Siswati (2021) entitled "The Effect of Rubber Ball Gripping Exercise on Muscle Strength in Non-Hemorrhagic Stroke Patients" showed an increase in muscle strength in both the intervention and control groups. The statistical test results showed a significant value (p = 0.01) in the intervention group and (p = 0.02) in the control group. Based on the average post-test score, the intervention group had a score of 3.71, which was higher than the control group's score of 2.43. This indicates that rubber ball grip training in the intervention group provided better results than ROM training in the control group (Mareta Sari & Kustriyani, 2023).

Based on an initial survey on November 20, 2024 conducted at the Want Jaya sub-district health center, there were interview results with health center officers who handled non-communicable disease cases when asked how to prevent stroke and what therapy was used and what percentage of stroke patients in the area, the results obtained were a number of post-stroke patients who were rehabilitated at home had never received rubber ball grip therapy and CIMT therapy, especially 32 of the 50 patients identified as having strokes in the Want Jaya health center center work area, including those in the villages of Pasie lamgarot, Pasie lubuk, Lubuk sukun, Kaye lee, aje pea. Based on interviews with stroke sufferers in the village, they never knew how to do rubber ball grip therapy and CIMT therapy (constraint induced movement therapy).

Research Method

The research used a quantitative method with a quasi-experimental design. The sampling technique used purposive sampling, with a total of 32 patients as respondents. The population in this study was 32 ischemic stroke patients from 5 of 50 villages.

Results and Discussion Results

Univariate Analysis

Table 1: Upper extremity muscle strength levels before and after rubber ball grip therapy

Therapy holding the ball	**Before Therapy Holding A Rubber Ball**	**After therapy holding a rubber ball**
	Frequency %	Frequency %
Normal	- -	10 62.5
Good	1 6.3	2 12.5
Enough	3 18.8	3 18.8
Not enough	1 6.3	1 6.3
Bad	4 25.0	- -
n't any	7 43.8	- -
Total	**16 100.0**	**16 100.0**

Source: primary data, 2025

Based on the data distribution table, before the intervention, most of the respondents were in the category of none, as many as 7 people (43%), bad 4 people (25%), sufficient and less than 3 people each (18.8%), and the good category was 1 person (6.3%). After the intervention, there was a striking shift in distribution, namely 10 people (62.5%) were normal, 2 people were good (12.5%), sufficient remained 3 people (18.8%) and the less than category was 1 person (6.3%).

Table 2: Category Of Upper Extremity Muscle Strength Levels Before And After Constraint Induced Movement Therapy (CIMT)

Constraint induced movement therapy (CIMT)	**Before do (CIMT)**	**After do (CIMT)**
	Frequency %	Frequency %
Normal	- -	6 37.5
Good	6 37.5	2 12.5
Enough	2 12.5	4 25.0
Not enough	2 12.5	3 18.8
Bad	2 12.5	1 6.3
n't any	4 25.0	- -
Total	16 100.0	16 100.0

Source: primary data, 2025

Based on the data distribution table before the intervention, most of the respondents were in the good category, as many as 6 people (37.5%), none 4 people (25.0%), sufficient, less and bad each 2 people (12.5%) and good 1 person (6.3%). After the intervention, there was a striking shift in distribution, namely 6 people (37.5%) normal, good 2 people (12.5%), sufficient increased to 4 people (25%). and the less category 1 person (6.3%).

Table 3: Average Values Before And After Rubber Ball Grasping Therapy And Constraint Induced Movement Therapy

Variable	**Mean**	**N**	**Std. deviation**	**Std.error Mean**
Before Therapy Holding A Rubber Ball	2.81	16	1,337	.344
After Therapy Holding A Rubber Ball	4.31	16	1,014	.254
Before Constraint Induced Movement Therapy	2.25	16	1,693	.432
After Constraid Induced Movement Therapy	3.65	16	1,365	.341

Source: primary data, 2025

Based on the results of descriptive analysis, it was found that the average muscle strength score before rubber ball grip therapy was 2.81 with a standard deviation of 1.337 and a standard error of 0.344. After rubber ball grip therapy, the average value increased to 4.31, with a standard deviation of 1.014 and a standard error of 0.254. Meanwhile, for Constraint-Induced Movement Therapy (CIMT), the average muscle strength before therapy was 2.25 with a standard deviation of 1.693 and a standard error of 0.432. After CIMT therapy, the average increased to 3.65, with a standard deviation of 1.365 and a standard error of 0.341. This indicates an increase in the average muscle strength score after therapy, as well as a decrease in data variability, reflecting more consistent results.

Table 4: Normality test

Variables	**Kolmogorov-Smirnov**			**Shapiro-Wilk**		
	Statistics	df	Sig.	Statistics	df	Sig.
Category Before MG	0.243	16	0.012	0.809	16	0.004
Category After MG	0.376	16	0.000	0.710	16	0.000
Category Before CIMT	0.224	16	0.031	0.820	16	0.005
Category After CIMT	0.229	16	0.025	0.865	16	0.023

Source: primary data, 2025

Based on the results of normality tests using the Kolmogorov-Smirnov and Shapiro-Wilk tests, it was found that all variables had non-normal data distributions. This is evident from the significance values (Sig.) in both tests, which were less than 0.05, for both pre- and post-therapy data. For ball grasping therapy (MG), the Kolmogorov-Smirnov test yielded a significant value of 0.012 before therapy and 0.000 after therapy, while the Shapiro-Wilk test yielded values of 0.004 before therapy and 0.000 after therapy. These results

indicate that the data distribution deviated from statistical normality.

A similar finding was found in the Constraint Induced Movement Therapy (CIMT) group. The Kolmogorov-Smirnov test yielded a significant value of 0.031 before therapy and 0.025 after therapy. The Shapiro-Wilk test yielded a significant value of 0.005 before therapy and 0.023 after therapy. Thus, all significance values < 0.05 indicate that the data in this group are also not normally distributed.

Because the data for all variables were not normally distributed, non-parametric tests were used in the subsequent analysis. The Wilcoxon Signed Ranks Test was used to examine the differences before and after therapy in each group, while the Mann-Whitney U test was used to compare effectiveness between the two groups.

Table 5: Wilcoxon Test Results on Muscle Strength Before and After Ball Gripping Therapy and CIMT

Variables	N	Mean	Z	Sig. (2-tailed)
Before therapy holding the ball	16	-		
After therapy holding the ball	16	8.50	-3,619	0.000
Before CIMT therapy	16	-		
After CIMT therapy	16	8.50	-3,666	0.000

Source: primary data, 2025

Based on the analysis using the Wilcoxon Signed Ranks Test, significant changes were found between pre- and post-therapy conditions for both Constraint Induced Movement Therapy (CIMT) and rubber ball grasping therapy. In CIMT therapy, all respondents (n = 16) showed improvement, with 16 positive ranks and no negative ranks or ties. A Z-value of -3.666 with a 2-tailed significance level (Asymp. Sig.) of 0.000 indicates that the improvement was statistically significant ($p < 0.05$).

A similar trend was observed in rubber ball grasping therapy, where all respondents (n = 16) experienced improvement with 16 positive ranks and no negative ranks or ties. A Z-value of -3.619 with a significance level of 0.000 indicates a significant difference between the results before and after therapy.

Table 6: Statistical test results with the Mann Whitney test after therapy

Data Group	N	Mean Rank	Sum of Ranks
Post Results Holding the Ball	16	19.03	304.50
Post Constraint Induced Movement Therapy (CIMT) Results	16	13.97	223.50
U = 87,500 **P** = 0.100			

Source: primary data, 2025

The Mann Whitney test results showed that there was no significant difference between ball grasping therapy and Constraint Induced Movement Therapy (CIMT) in improving motor skills in post-stroke patients. This is proven by the significance value (p-value) of 0.100 which is greater than the significance level of $\alpha = 0.05$ (0.100 > 0.05). In addition, the Mann Whitney U value of 87,500 also exceeds the critical value in the table. Based on these results, it can be concluded that both types of therapy have equal effectiveness in improving patients' motor skills, so H_0 is accepted and H_1 is rejected.

Discussion

a. Muscle strength levels before rubber ball grip therapy and Constraint Induced Movement Therapy (CIMT)

Based on the distribution of data from 32 respondents, before receiving rubber ball grip therapy and Constraint Induced Movement Therapy (CIMT), all respondents demonstrated relatively low muscle strength. The average muscle strength score before rubber ball grip therapy was 2.81, which then increased for all respondents after therapy, with an average score of 4.31. Meanwhile, in the CIMT therapy group, the average muscle strength before the intervention was 2.25, and after therapy, it increased to 3.65.

Siswati's (2021) research showed that rubber ball grip training can increase muscle strength in non-hemorrhagic stroke patients. The group receiving rubber ball training experienced greater muscle strength gains than the group receiving only ROM exercises (Mareta Sari & Kustriyani, 2023). Meanwhile, Kurniawan's (2013) research stated that Constraint Induced Movement Therapy (CIMT) can reduce disability and improve the use of weak upper limbs, although evidence from movement analysis is still limited (ShiYX, 2018). Yoon's (2020) research also found that CIMT therapy, administered regularly for two weeks, improved motor function in stroke patients. This finding is supported by Rizki et al.'s (2022) findings, which showed that CIMT significantly improved upper extremity function in post-stroke patients, with a p-value of 0.008.

b. Muscle strength levels after rubber ball grip therapy and Constraint Induced Movement Therapy (CIMT)

The study results showed that after receiving rubber ball gripping therapy and Constraint Induced Movement Therapy (CIMT), 32 respondents experienced increased muscle strength, reaching a good level. This finding indicates a significant difference between the respondents' muscle strength levels before and after the therapeutic intervention. This improvement indicates that both types of therapy have a positive impact on motor function, particularly in improving muscle contraction ability in post-stroke patients.

These study results align with the findings of Rahmawati (2019), who stated that simple exercises such as gripping a rubber ball can provide effective proprioceptive and neuromuscular stimulation in improving hand muscle strength in stroke patients. Similarly, research conducted by Yuliani and Permana (2021) showed that CIMT therapy significantly improved motor control through the principle of forced use of weakened limbs. These two therapy methods have different mechanisms of action but share the same goal: reactivating weakened motor systems through structured, intensive, and repetitive exercise.

Although the statistical test results did not show a quantitatively significant difference, both therapies are still considered clinically effective due to their functional impact on increasing muscle strength. The choice of therapy can be tailored to the patient's condition, preferences, and the resources available at the rehabilitation facility.

Physiologically, muscles function as active organs of movement, playing a crucial role in generating force through contraction. Muscle strength is defined as the ability of a muscle to contract and generate force (Aisiyah, 2021), or as the ability of a muscle or group of muscles to withstand maximum force during contraction (Ministry of Health, 2021). Based on the research results and theoretical studies, it can be concluded that rubber ball grip therapy and Constraint Induced Movement Therapy (CIMT) significantly increase muscle strength. This confirms that the interventions provided clinical benefits in supporting the recovery of motor function in post-stroke patients.

c. Comparison Of Rubber Ball Graining Therapy and Constraint Induced Movement Therapy (CIMT) on Improving Muscle Strength in Ischemic Stroke Patients in the Want Jaya Pukes Ceter Work Area

This study specifically aimed to determine whether there was a difference in effectiveness between rubber ball grip therapy and Constraint Induced Movement Therapy (CIMT) in improving upper extremity muscle strength in stroke patients. To address this objective, statistical analysis was conducted using the non-parametric Mann-Whitney U Test.

The test results showed a U-value of 87.500 with a significance level (p) of 0.100. Because the p-value was greater than the 0.05 threshold, it can be concluded that there was no statistically

significant difference between hand muscle strength results after ball grip therapy and CIMT therapy. In other words, both intervention methods demonstrated comparable effectiveness in improving hand motor skills in stroke patients.

Although the difference was not statistically significant, descriptive analysis results showed that the ball grip therapy group had a mean rank of 19.03, higher than the CIMT group, which had a mean rank of 13.97. This indicates a clinical trend that patients undergoing ball grip therapy experienced greater increases in muscle strength. However, due to the relatively small sample size (16 people each), it is likely not statistically strong enough to demonstrate a meaningful difference. Furthermore, variations in respondent characteristics such as age, duration of stroke, and comorbid conditions may also influence therapy outcomes.

These results align with research by Rahmawati (2019), which found that simple therapy, such as gripping a rubber ball, can provide effective proprioceptive and neuromuscular stimulation in improving hand muscle strength in stroke patients. Meanwhile, research by Yuliani and Permana (2021) showed that CIMT also provides significant results on motor control through the principle of forced use of weakened limbs. These two methods work through different mechanisms but share the same goal: reactivating weakened motor systems through structured and repetitive exercise. Therefore, although no statistically significant differences were found, both can still be considered clinically effective and can be selected based on the patient's condition, preferences, and available resources.

Conclusion

1. Before receiving rubber ball grip therapy, the 32 respondents had an average muscle strength score of 2.81. After therapy, the muscle strength score increased to 4.31. Meanwhile, for Constraint Induced Movement Therapy (CIMT), the average muscle strength of the 32 respondents before therapy was 2.25. After therapy, the muscle strength score increased to 3.65.
2. The analysis using the Wilcoxon test showed a p-value of 0.00 with a significance level of 0.05.

Suggestion

The results of this study are expected to be beneficial for various parties. For institutions, this research is expected to serve as an initial reference for developing nursing interventions in the field of motor rehabilitation. Researchers are also expected to conduct long-term evaluations of the therapy's effectiveness and include other variables such as duration of illness, daily activity level, or patient motivation during therapy sessions.

Furthermore, it is recommended that community health centers (Puskesmas) adopt rubber ball grip therapy and CIMT as part of rehabilitative interventions in physiotherapy or community nursing services. Puskesmas are also expected to train nurses and health workers to guide patients through the exercises correctly and safely. Furthermore, it is hoped that respondents can continue the exercises independently at home under the supervision of health workers or family. Routine exercises such as ball grip can maintain and even increase the muscle strength achieved during therapy. Finally, for other researchers, this study could expand the sample size, use a randomized experimental method, and evaluate the effects of therapy over a longer period. Furthermore, a combination of physical therapy and psychosocial approaches could be used to determine their synergistic effects on motor recovery.

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