

The Effect of Cylindrical Grip Exercise on Increasing Upper Extremity Muscle Strength in Non-Hemorrhagic Stroke

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ABSTRACT

Background: Non-hemorrhagic stroke is the most common type of stroke and can cause disability due to muscle weakness in the extremities, especially the upper extremities. One effort to prevent disability is to provide maintenance interventions in the form of physical exercises such as Range of Motion (ROM) and cylindrical grip exercises to increase muscle strength. **Objective:** This study aims to determine the effectiveness of cylindrical grip exercises on increasing upper extremity muscle strength in non-hemorrhagic stroke patients. **Methods:** This study used This study used a quantitative quasi-experimental design with a pre-test post-test with control design. The sample of this study was 44 respondents who were randomly divided into two groups. **Results:** The results of the Wilcoxon test analysis showed that the 22 respondents who received the functional cylindrical grip exercise intervention had an effect on increasing upper extremity muscle strength in nonhemorrhagic stroke patients with a p-value of 0.001, it shows 7 respondents (31.8%) experienced an increase in muscle strength, reaching a score of 4 and 5 in 3 respondents (13.6%). **Conclusion:** This study shows that functional cylindrical grip exercises for 10 minutes a day for 3 days have an effect on increasing upper extremity muscle strength in non-hemorrhagic stroke patients.

Keywords: Cylindrical Grip Exercise, Muscle Strength, Range Of Motion (ROM), Stroke, Upper Extremity.

BACKGROUND

Stroke is a rapidly developing clinical manifestation of focal or global neurological deficits, which can worsen and persist for 24 hours or more, even leading to death. Stroke is defined as sudden, progressive, and rapid brain damage caused by non-traumatic circulatory disorders. This disorder suddenly causes symptoms such as paralysis on one side of the face or limbs, slurred speech, slurred speech, changes in consciousness, visual disturbances, and others. Stroke, or Cerebrovascular Accident

(CVA), is a sudden disruption of neurological function due to impaired blood flow to the brain, resulting in disability or death (G. Z. Rahayu et al., 2021).

There are two types of strokes: hemorrhagic stroke and ischemic stroke (non-hemorrhagic stroke). Hemorrhagic stroke is caused by bleeding in the brain, while ischemic stroke (non-hemorrhagic stroke) is caused by a blockage of a blood vessel. Non-hemorrhagic stroke is the most common type of stroke. Non-hemorrhagic strokes are generally caused by blockages due to thrombus or embolism. According to data from the World Stroke Organization (WSO, 2022), stroke is the second leading cause of death and the third leading cause of disability (Feigin et al., 2022). Approximately 15 million people suffer a first-time stroke each year, with one-third of these cases, or approximately 6.6 million, resulting in death (3.5 million women and 3.1 million men). Furthermore, the prevalence of stroke patients experiencing disability or paralysis is 21.3% (Ju et al., 2022). Approximately 87% of stroke sufferers have ischemic strokes (non-hemorrhagic strokes).

According to data from the Southeast Asian Medical Information Center (SEAMIC) in 2018, Indonesia had the highest stroke mortality rate at 15.4%, followed in order by the Philippines, Singapore, Brunei, Malaysia, and Thailand (Ayuni et al., 2021). Based on 2018 Basic Health Research (Riskesdas), the prevalence of stroke in Indonesia is 10.9% of the population, equivalent to 2,120,362 people. The highest prevalence occurs in East Kalimantan Province at 14.7%, and the lowest in Papua at 4.1%. In Central Java Province, the prevalence is 96,794, or 11.8% (Riskesdas, 2018). A preliminary study conducted at Dr. Moewardi Hospital found that an average of 80 patients were hospitalized with non-hemorrhagic strokes per month over the past three months.

Patients with non-hemorrhagic strokes often experience decreased consciousness accompanied by decreased activity. Increased intracranial pressure is caused by decreased blood flow to the brain, which leads to cerebral ischemia. This decreased consciousness results from a sudden decrease in oxygen supply to the brain, which gradually leads to tissue hypoxia. If left untreated for a long time, patients will experience neuromuscular disorders, with signs of joint weakness and even disability. The high incidence of disability due to stroke will increase the burden of disease. One effort to reduce the incidence of disability is to provide interventions to improve muscle strength in stroke patients. This is consistent with which states that patients who are hospitalized for long periods can experience risks and side effects from intensive care, both from the disease suffered, the therapy provided, and the prolonged bed rest position. Furthermore, research conducted by (Kusuma, A. S., & Sara, 2020) also states that someone who experiences bed rest will lose muscle strength (disuse atrophy) an average of 3% per day.

Management of non-hemorrhagic stroke consists of pharmacological and non-pharmacological interventions. Pharmacological management for non-hemorrhagic stroke patients includes blood pressure, temperature, blood sugar, seizure management, fibrinolysis, antiplatelet therapy, anticoagulants, deep vein thrombosis prophylaxis, depression management, and risk factor management. Non-pharmacological management includes physiotherapy (Saidi & Andrianti, 2021). Many stroke patients experience disability, so management is essential to prevent musculoskeletal system dysfunction, particularly muscle strength, which can lead to disability. One management

or intervention in nursing practice to improve muscle strength is early mobilization exercises in the form of Range of Motion (ROM) exercises. In this research shows 7 respondents (31.8%) experienced an increase in muscle strength, reaching a score of 4 and 5 in 3 respondents (13.6%).

Range of Motion (ROM) exercises are exercises performed to maintain or improve the level of complete joint movement and increase muscle mass and tone. ROM exercises are typically performed on patients with limited mobility who are unable to perform some or all range-of-motion exercises independently, on complete bed rest, or with complete paralysis of the extremities. These exercises aim to maintain muscle strength, promote joint mobility, stimulate blood circulation, and prevent deformities (Agusrianto & Rantesigi, 2020).

ROM exercises can be combined with cylindrical grip exercises, which are useful for increasing muscle strength in the upper extremities. Cylinder grip exercises are functional hand exercises involving holding cylindrical objects, such as tissue rolls, glass bottles, or cylindrical rubber balls, in the palm of the hand to move the fingers to grasp correctly and perfectly. Cylinder grips can help develop balance skills for fine motor paralysis in the fingers (Nursalam et al., 2020). The above results are also due to the patients' strong desire and motivation to perform cylindrical grip exercises. In addition to improving hand muscle strength, cylindrical grip exercises are expected to prevent disability in stroke patients (Mardiana et al., 2021). Based on the description above, the researcher is interested in conducting research on the effect of Cylindrical Grip Exercise on increasing upper extremity muscle strength in non-hemorrhagic stroke patients at Dr. Moewardi Hospital

OBJECTIVE

The general objective of this study was to determine the effect of Cylindrical Grip Exercise on increasing upper extremity muscle strength in non-hemorrhagic stroke patients at Dr. Moewardi Hospital.

METHODS

This study uses a quantitative research type that uses a quasi-experimental design with a pre-posttest method with a control group design. This study involved two groups, namely the intervention group that received Cylindrical Grip Exercise, and the control group that only did the Range of Motion (ROM) therapy program. This procedure is performed for 15-30 minutes in the morning at 9:00 a.m. after breakfast and medication, with a minimum of four repetitions of each movement. This exercise is performed over three sessions. This study was conducted in the inpatient ward of Dr. Moewardi Hospital, namely in the Anggrek 2 ward and HCU Anggrek 2 Stroke Unit. Data collection for this study was carried out from October 29 to November 30, 2024. The sample of this study amounted to 44 respondents. The sample consisted of 2 groups of respondents, namely 22 respondents in the intervention group and 22 respondents in the control group. The sampling technique used in this study was a purposive sampling technique. The inclusion criteria that will be given are: non-hemorrhagic stroke patients, Patients experiencing upper extremity muscle strength disorders, Willing to be respondents, GCS 14-15 (composmentis), and moderate to mild stroke patients.

RESULTS

Table 1. Frequency distribution of respondents by gender

Characteristic Gender	Intervention		Control	
	Frequency	(%)	Frequency	(%)
Male	10	45.5	11	50.0
Female	12	54.5	11	50.0
Total	22	100.0	22	100.0

Based on table 1, it shows that the gender characteristics in this study, in the intervention group there were more female respondents, namely 12 respondents (54.5%), while in the control group there were an equal number of male and female respondents, namely 11 respondents (50.0%).

Table 2. Frequency distribution of respondents based on age

Characteristic Age	Intervention		Control	
	Frequency	(%)	Frequency	(%)
40-49 years	3	13.6	4	18.2
50-59 years	10	45.5	7	31.8
60-70 years	7	31.8	11	50.0
>70 years	2	9.1	-	-
Total	22	100.0	22	100.0

Based on table 2, it shows that the largest number of respondents in the intervention group were aged 50-59 years, amounting to 10 respondents (45.5%), while in the control group, there were 11 respondents aged 60-70 years (50.0%).

Table 3. Frequency distribution of respondents based on smoking history

Characteristic	Intervention		Control	
	Frequency	(%)	Frequency	(%)
Smoking	10	45.5	11	50.0
No Smoking	12	54.5	11	50.0
Total	22	100.0	22	100.0

Based on table 3, it shows that the frequency of respondents who smoked in this study was the same, there were 10 respondents (45.5%) in the intervention group and 11 respondents (50.0%) in the control group.

Table 4. Frequency distribution of upper extremity muscle strength before intervention

Characteristic MMT Score	Intervention		Control	
	Frequency	(%)	Frequency	(%)
2	5	22.7	7	31.8
3	14	63.6	14	63.6
4	3	13.6	1	4.5
5	-	-	-	-
Total	22	100.00	22	100.00

Based on table 4, it shows that the upper extremity muscle strength in non-hemorrhagic stroke patients assessed through the MMT score before being given the cylindrical grip exercise intervention was highest in the intervention group and the control group,

namely with an MMT score of 3 for 14 respondents (63.6%) for the intervention group and 14 respondents (63.6%) for the control group.

Table 5. Frequency distribution of upper extremity muscle strength after intervention

Characteristic MMT Score	Intervention		Control	
	Frequency	(%)	Frequency	(%)
2	4	18.2	6	27.3
3	8	36.4	10	45.5
4	7	31.8	6	27.3
5	3	13.6	-	-
Total	22	100.00	22	100.00

Based on table 5, it shows that upper extremity muscle strength in non-hemorrhagic stroke patients assessed through the MMT score after being given cylindrical grip exercise intervention in the intervention group experienced an increase to a score of 4 in 7 respondents (31.8%) and a score of 5 in 3 respondents (13.6%). Meanwhile, in the control group, the increase to a score of 4 was 6 people (27.3%).

Table 6. Wilcoxon Test n=44

Upper Extremity Muscle Strength							
		n	Min	Max	Mean	SD	Sig. (2-tailed)
Intervention	Pre-test	22	2	4	2.91	0.610	0.001
	Post-test	22	2	5	3.41	0.959	
Control	Pre-test	22	2	4	2.73	0.550	0.014
	Post-test	22	2	4	3.00	0.756	
	Post-test	22	2	4	3.00	0.756	

Based on the table above, it can be concluded that each intervention and control group was given routine ROM therapy had a p-value of 0.001 and 0.014. Therefore, it can be concluded that cylindrical grip exercise has an effect on increasing upper extremity muscle strength in non-hemorrhagic stroke patients. Furthermore, ROM also has an effect on increasing upper extremity muscle strength in non-hemorrhagic stroke patients

Tabel 7. Uji Mann-Whitney

Group		n	Asymp. Sig. (2-tailed)
Upper Extremity Muscle Strength	Intervention	22	0.157
	Control	22	

Based on the Mann-Whitney test table between the intervention group and the control group, the p-value results were 0.157, so statistically there was no significant difference between cylindrical grip exercise and ROM in increasing upper limb muscle strength in non-hemorrhagic stroke patients.

DISCUSSION

Respondent Characteristics

Based on the research results, it appears that the majority of respondents were female,

with 23 respondents. This finding is consistent with the higher incidence of stroke in women than in men. More than 55,000 women suffer a stroke each year. Hormonal factors also contribute; testosterone in men can increase blood LDL levels, but the risk of stroke in women increases after menopause. This is because estrogen in women has numerous benefits for the health of all organs in the body, including the heart and blood vessels. However, when women experience menopause, estrogen begins to decline, resulting in more women experiencing stroke in later life. Furthermore, women have the hormone estradiol, which can dilate the vascular endothelium and increase blood flow, making them more susceptible to stroke (Abdu & Seyoum, 2022).

Furthermore, women have a higher life expectancy than men, which contributes to a 20-21% risk of stroke. In fact, strokes in women are at greater risk of being severe than in men (Abdu & Seyoum, 2022). Women are also more susceptible to autoimmune diseases. A number of inflammatory disorders can also cause blood vessel damage or blood clots, which increase the risk of stroke. Factors that can increase a woman's risk of stroke include obesity, high cholesterol, hypertension, lack of exercise, poor sleep quality, excessive use of contraceptives, higher levels of depression, and smoking (Tamam, 2020). Based on the discussion above, it can be concluded that in this study, non-hemorrhagic stroke patients were more likely to be female.

The results showed that 10 respondents were aged 45-59 in the intervention group, and 10 respondents were aged 60-70 in the control group. This is consistent with other research showing that stroke patients were most commonly found in the 50-60 age group (3,496 respondents), followed by 2,868 patients under 50, and 1,964 patients over 60 (Zhong et al., 2023). Furthermore, the global increase in stroke cases in those under 50 is 10-14%. In the United States, the stroke incidence rate among people aged 20-54 increased from 17 per 100,000 to 28 per 100,000.

The degenerative theory explains the aging process as a condition in which biological function and bodily abilities decline with age. The degenerative process that occurs in older adults is a natural process, where blood vessels become stiffer due to the formation of plaque in the blood. This risk doubles after the age of 55. Two-thirds of all strokes occur in people over the age of 65. However, this does not mean that strokes only occur in older adults, as strokes can affect all age groups in (Tamam, 2020).

Based on data and the degenerative theory, it appears that older age is the age at which non-hemorrhagic stroke patients experience significant changes. Therefore, it is important to recognize that aging brings significant changes to blood vessels.

The results showed that several respondents had a history of smoking, with 10 respondents (45.5%) in the intervention group and 11 respondents (50.0%) in the control group. Smoking is a risk factor for cardiovascular disease. Smoking is a major cause of hypertension, which is a risk factor for stroke. A cigarette contains tar, nicotine, and carbon monoxide, which contribute to damage to the vascular endothelium, increase blood viscosity, and bind oxygen in the blood. Another study showed a link between smoking and stroke with a p-value of 0.001 (<0.05).

Smoking can cause increased blood pressure due to the nicotine and carbon monoxide in tobacco smoke. An increase in systolic blood pressure of 10 mmHg and diastolic blood pressure of 5 mmHg can increase the risk of stroke by up to 40%. Carbon

monoxide in cigarette smoke can bind to hemoglobin in the blood, forming carboxyhemoglobin, which can reduce blood oxygen levels. Carbohydrate-rich hemoglobin increases inflammatory proteins, increasing the risk of stroke by 3.5 times. The relationship between smoking and stroke is complex. Smoking can affect stroke severity, response to treatment and care, and long-term recovery. Smoking can trigger post-stroke delirium, which includes cognitive decline, decreased consciousness, and disorientation. Other research suggests that reducing smoking can reduce the risk of primary stroke. Based on the discussion above, smoking is a risk factor for cardiovascular disease. Furthermore, smoking can also cause hypertension, which is a risk factor for stroke. Therefore, it can be concluded that the relationship between smoking and stroke is complex.

The results of the study showed that the majority of upper extremity muscle strength before the cylindrical grip exercise intervention had an MMT score of 3 (13 respondents (59.1%)), while in the control group, the score was 13 (59.1%). In this study, the respondents were stroke patients experiencing hemiparesis and whose stroke had lasted more than 24 hours. Other research indicates that the MMT score at the beginning of a stroke is between 3 and 4 (Roman et al., 2022).

Stroke occurs due to a blockage or rupture of a blood vessel, disrupting blood flow to the brain. As a result, the brain lacks nutrients and oxygen, leading to cell death. The presence of a clot or lesion in a blood vessel in the brain causes obstruction of blood flow, causing ischemia in the brain's nerve cells. Nerve cells that experience ischemia become damaged and dysfunctional within minutes. The location and extent of the dysfunction in the brain's nerve cells determine the type of neurological deficit that occurs. Neurological deficits can include motor or sensory dysfunction. Motor deficits that can occur include hemiparesis or hemiplegia.

Approximately 69-80% of stroke patients experience motor dysfunction in the upper extremities. This motor dysfunction is in the opposite direction to the part of the brain affected by the stroke. Upper extremities affected by hemiparesis exhibit limited flexion and movement patterns. Patients with hemiparesis who do not receive immediate rehabilitation therapy can develop joint and muscle stiffness, ultimately leading to paralysis. One management or intervention in nursing practice to increase muscle strength in patients is early mobilization exercises in the form of Range of Motion (ROM) exercises. ROM exercises can be combined with functional hand exercises, such as cylindrical grip exercises (Agusrianto & Rantesigi, 2020).

The results of the study showed that the majority of upper extremity muscle strength after cylindrical grip exercise intervention had an MMT score of 5 (3 respondents (13.6%)), while in the control group, the MMT score was 4 (6 respondents (27.3%)). In stroke patients, the muscle recovery period varies depending on the severity of the stroke, neurorehabilitation capacity, early treatment, and movement exercises performed by the patient (Roman et al., 2022).

Restoring fine motor skills is more difficult than restoring gross motor skills. For example, fine motor skills in the hand involve the small muscles in the fingers and wrist, while gross motor skills involve the arms. One way to restore fine motor skills is through cylindrical grip exercises, which involve holding a cylindrical rubber ball to stimulate the nerves in the fingers (Nursalam et al., 2020). Cylindrical Grip is a

functional hand exercise involving gripping a cylindrical object. This exercise involves the flexor digitorum profundus, flexor digitorum sublimis, and interosseous muscles, assisting when greater force is required. Cylindrical Grip exercises benefit from increased muscle strength in the upper extremities, particularly the wrist joint, as well as stability in the metacarpophalangeal joint and fingers (phalanges) (Choirunnisya et al., 2023).

This aligns with research showing increased muscle strength after movement training intervention, with initial wrist muscle strength scores ranging from 3/4 to 4/5 (Museva et al., 2024). Optimal results require consistent, repeated, and intensive intervention.

Increased upper extremity muscle strength in non-hemorrhagic stroke patients in the intervention group before and after cylindrical grip exercise

Based on the results of the study using the Wilcoxon test, the mean value in the intervention group before cylindrical grip exercise was 2.73 and after the intervention, the mean was 3.23. This indicates an increase in average muscle strength through the MMT score before and after the intervention of 0.5. This is consistent with research conducted by Rahayu (2023), which showed an increase in average upper extremity muscle strength after cylindrical grip exercise of 0.78 with a p-value of 0.001, indicating that cylindrical grip exercise has an effect on increasing upper extremity muscle strength in non-hemorrhagic stroke patients (E. S. Rahayu, 2023).

The goal of the cylindrical grip exercise intervention in the intervention group was to train to increase upper extremity muscle strength, support the recovery of upper extremity movement and function, and prevent stiffness (Aisiyah, 2021). Cylindrical grip exercises, involving holding a cylindrical rubber ball, can stimulate the nerves in the fingers (Nursalam et al., 2020). Cylindrical grip is a functional hand exercise involving grasping a cylindrical object. This involves functional activity, particularly the flexor digitorum profundus, flexor digitorum sublimis, and interosseous muscles, which assist when greater force is required. Cylindrical grip exercises benefit from increased muscle strength in the upper extremities, particularly the wrist joint, as well as stability in the metacarpophalangeal joint and fingers (phalanges) (Choirunnisya et al., 2023).

The results showed a p-value of 0.005 for the intervention group, indicating that cylindrical grip exercise had an effect on increasing muscle strength in non-hemorrhagic stroke patients. This finding aligns with research on the effect of cylindrical grip exercise on upper extremity muscle strength in non-hemorrhagic stroke patients, which had a p-value of 0.000 (Pratiwi, 2023).

Increased upper extremity muscle strength in non-hemorrhagic stroke patients in the control group before and after intervention according to hospital standards

In the control group, the average score before ROM was 2.59 and after ROM was 2.82. This indicates an average increase in muscle strength of 0.23. This aligns with research on early passive ROM on motor function in stroke patients, which showed a mean difference of 1.03. ROM intervention in the control group aims to increase upper extremity muscle strength, activate the sensory-motor cortex, and improve patient motor function. The results of this study showed a p-value of 0.025 for the control group, indicating an effect of ROM on upper extremity muscle strength in non-hemorrhagic

stroke patients.

Passive ROM exercises can stimulate, increasing chemical, neuromuscular, and muscular activation. Smooth muscles in the extremities contain actin and myosin filaments, which have chemical properties and interact with each other. This interaction is activated by calcium ions and adenosine triphosphate (ATP), which is then broken down into adenosine diphosphate (ADP) to provide energy for limb muscle contraction. Neuromuscular stimulation increases the stimulation of limb muscle nerve fibers, particularly the parasympathetic nervous system, which stimulates acetylcholine production, resulting in contraction (Wulan & Wahyuni, 2022).

The mechanism through the muscles, especially limb smooth muscles, increases metabolism in the mitochondria to produce ATP, which is utilized by limb smooth muscles as energy for contraction and increases limb smooth muscle tone, an indicator of muscle strength. Longer muscles contract with greater force than shorter muscles. The maximum contraction force at the muscle length increases, and the longer the antagonist muscle, the more force it contracts than the shorter muscle. If a muscle continues to shorten below its normal length, the sarcomeres at the ends of the muscle fibers will disappear. Through this process, muscles are continuously reshaped to achieve the appropriate length for muscle contraction. All muscles in the body are continuously reshaped to adapt to their required functions. This process of remodeling (diameter, length, strength, blood supply) occurs rapidly over a period of weeks; normally, muscle contractile proteins can be completely replaced within 2 weeks (Syafni, 2020). This is in line with research showing that the p-value of providing active ROM in stroke patients with upper extremity weakness is 0.001.

Comparison of the average increase in muscle strength in non-hemorrhagic stroke patients between the intervention and control groups

Based on the results of the study, the intervention and control groups, totaling 44 respondents, were tested using the Mann-Whitney test with a p-value of 0.140. This indicates there was no significant difference between the intervention group performing cylindrical grip exercises and the control group performing ROM. Essentially, cylindrical grip exercises and ROM have an effect on increasing upper extremity muscle strength in non-hemorrhagic stroke patients. The upper extremities require gentle movements that directly contact nerves to improve fine motor skills.

In this research shows 7 respondents (31.8%) experienced an increase in muscle strength, reaching a score of 4 and 5 in 3 respondents (13.6%). Therefore, that functional cylindrical grip exercises for 10 minutes a day for 3 days have an effect on increasing upper extremity muscle strength in non-hemorrhagic stroke patients. Stimulates the brain's motor nerves to release acetylcholine, which activates calcium and troponin. This then leads to the formation of actin and myosin proteins, which improve muscle function during movement. If ROM is not performed early, it can lead to atrophy, muscle contractures, tenderness, and worsening muscle strength. The cylindrical grip exercises are an appropriate choice because they can help develop balance skills for those with fine motor paralysis in the fingers (Nursalam et al., 2020). In cylindrical grip exercises, the fingers are flexed with the thumb bent over the index finger and the middle finger. This causes movement in the wrist joint, metacarpophalangeal joint, and phalanges (Mardiana et al., 2021). These exercises train

muscles to mobilize. Mobilizing muscles can prevent stiffness, improve blood circulation, and increase muscle mass. Continuous cylindrical grip exercises can stimulate surrounding muscles to contract. Regular movement stimulation can improve grip strength in the short term and, over time, muscle strength (Aisiyah, 2021).

Hand ROM (Root Movement) is the most frequently used intervention for stroke patients with hemiparesis. ROM can be performed passively or actively. Passive ROM is performed by the patient with assistance, while active ROM is performed by the patient without assistance. In stroke patients, ROM is best administered in the early stages of the stroke, less than 6 months after the stroke. ROM requires both passive and active joint movement to maintain joint mobility and train motor skills. The overall function of ROM and cylindrical grip functional hand exercises is similar, as they are part of active ROM. ROM also stimulates the brain's motor neurons to release acetylcholine, which activates calcium and troponin. This then leads to the formation of actin and myosin proteins, improving muscle function during movement. Failure to initiate ROM exercises early can lead to atrophy, muscle contractures, tenderness, and worsening muscle strength.

Overall, although some studies have shown positive effects of cylindrical grip exercise on upper extremity muscle strength in non-hemorrhagic stroke patients, these results are inconsistent across studies. Therefore, further research with more rigorous methodology and better control of variables that may influence outcomes is needed to clarify the true benefits of cylindrical grip exercise in non-hemorrhagic stroke patients.

CONCLUSION

Based on the results of research on 44 respondents who were divided into an intervention group with 22 respondents given cylindrical grip exercise and a control group with 22 respondents given ROM exercise on increasing upper limb muscle strength in non-hemorrhagic stroke patients in the Orchid ward 2 and stroke unit of Dr. Moewardi Surakarta Regional Hospital, it can be concluded that: There is an effect of cylindrical grip exercise on increasing upper limb muscle strength in non-hemorrhagic stroke patients. Proven by the results of the Wilcoxon test with a p-value of 0.001 (>0.05).

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