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The Effect of Cylindrical Grip ROM Exercise Therapy on Finger Grip Muscle Strength in The Upper Extremities of Post Stroke Patients

Rizky Meuthia Pratiwi
Nursing Department, Universitas Bina Sehat PPNI Mojokerto, Indonesia

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Abstract

One of the conditions in post-stroke patients is that post-stroke sensory and motor disorders occur on one side of the body, resulting in balance disorders including muscle weakness.Based on a preliminary study conducted in June 2023, it was discovered that 5 respondents who were in the Inpatient Room at Siti Hajar Hospital Sidoarjo most often experienced paralysis in the upper extremities caused by decreased muscle tone so that patients were unable to move their bodies (immobilization). extremity motor abilities through a rehabilitation program.Cylindrical Grip which is a functional hand exercise by holding a cylindrical object such as a glass, bottle, rolled tissue in the palm of the hand (Kleim & Jones, 2008 in Soloman, 2013). The benefits of this therapy are to increase the client's independence and increase muscle strength. Movement exercises can also be useful for improving muscle tone and tendon reflexes.This research used Pre-Experimental design with One Group Pretest and Posttest approach. The population was all post-stroke patients in the inpatient ward who experienced paralysis of the upper right/sinistra extremities at Siti Hajar Hospital. The results of the study proved that there was a change in the value of finger grip muscle strength before and after Cylindrical Grip ROM exercise therapy. The majority of respondents had finger grip muscle strength in the weak category, 23 respondents (76.7%) after being given therapy, different results were obtained, namely the majority of respondents had finger grip muscle strength in the weak category, 15 respondents (50.02). This number decreased after the intervention. Pre and Post data was carried out using the Paired T Test which stated that there was an effect of Cylindrical Grip Exercise Therapy on Finger Grip Muscle Strength in post-stroke patients.

✉Correspondence Address:
Universitas Bina Sehat PPNI Mojokerto – East Java, Indonesia
Email : rizkymeuthia.stikesppni@gmail.com
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INTRODUCTION

Stroke is an acute focal and global brain functional disorder due to cerebral vascular disease, where the signs and symptoms correspond to the part of the brain affected (Qomariyah et all, 2022). In general,*Stroke* divided into two types, namely*Non Hemorrhagic Stroke*and*Hemorrhagic Stroke*. *Hemorrhagic Stroke*caused by intracranial hemorrhage accompanied by decreased patient consciousness, meanwhile*Non Hemorrhagic Stroke*is a disorder caused by*ischemia, thrombosis, embolism*and narrowing of the lumen (Irawati et all, 2016). Based on 2010 NCHS data, stroke is the third leading cause of death in the United States after heart disease and cancer (*Heart Disease and Stroke Statistics 2010 Update: A Report from American Heart Association*), explained that from 2008, 795,000 people in the US experienced a stroke every year and 610,000 people had a stroke for the first time (Indrawati, 2018). In the Asian region, the incidence of hemorrhagic stroke is around 30% and ischemic stroke is 70% (WHO, 2010). Data in Indonesia shows a trend of increasing stroke cases in terms of deaths, incidence and disability.

The mortality rate based on age is: 15.9% (aged 45-55 years) and 26.8% (aged 55-64 years) and 23.5% (aged 65 years). The incidence of stroke (incidence) was 51.6/100,000 population and disability; 1.6% did not change; 4.3% is getting worse. The results of the 2018 Indonesian Basic Health Research show that the prevalence of stroke in Indonesia is 10.9 per mil, while in East Java Province it is above the national prevalence, namely around 12 per mil (Ministry of Health of the Republic of Indonesia, 2019). The distribution of stroke cases in East Java in 2020 shows that the highest stroke cases (>1,218 cases) were in Surabaya City, Malang Regency, Trenggalek Regency, Bangkalan Regency, Jember Regency, Ngawi Regency, Gresik Regency, Sidoarjo Regency, Banyuwangi Regency, and Regency Mojokerto. There are more male stroke sufferers (76.8%) than females (23.2%) (Putri, 2023). Based on a preliminary study conducted in June 2023, it was discovered that 5 respondents who were in the Inpatient Room at Siti Hajar Hospital Sidoarjo experienced paralysis in the upper extremities most often due to decreased muscle tone so that the patient was unable to move his body (immobilization). The patient has also never undergone therapy or exercise independently that focuses on increasing muscle strength in his extremities.

Stroke can cause various disorders such as decreased muscle tone, decreased ability to move the affected body part and inability to carry out certain activities. Stroke patients experience weakness on one side of the body due to decreased muscle tone, making them unable to move their body (immobilization). Immobilization that does not receive proper treatment will cause complications in the form of*tone abnormalities, orthostatic hypotension, deep vein thrombosis* and contractures (Indrawati, 2018). Stroke sufferers will experience some form of hemiparesis or hemiplegia during the sub-acute and/or chronic stages and disturbances in other physical functions including speech, swallowing, sensation, balance and coordination so that stroke sufferers then need some form of assistance in carrying out activities of daily living (Sudarsih, 2022).

The way to minimize disability after a stroke is rehabilitation. One way of rehabilitation for stroke sufferers is exercise therapy. Exercise therapy is one way to speed up patient recovery from injury and disease, which is managed using active and passive movements. Passive movements are movements that are moved by another person, while active movements are movements produced by the contraction of one's own muscles. (Insrawati, 2018). Restoration of limb strength is still the main problem faced by stroke patients who experience hemiparesis. About 80% of patients experience acute hemiparesis in the upper extremities and only about a third are fully functional.

Complications that can occur in stroke patients if they do not follow a rehabilitation program include immobilization disorders which can cause muscle weakness, atrophy and contractures. The final impact of the high number of stroke sufferers can cause patients to experience body weakness for a long time, leading to disability until the end of their life (Ministry of Health of the Republic of Indonesia, 2015 Jung, 2019) (Sudarsih, 2022). Stroke patients need improvement in extremity motor skills through a rehabilitation program (Park & Park, 2016). One effort to prevent permanent disability in stroke patients is that it is necessary to carry out early mobilization exercises in the form of ROM (Range of Motion) exercises which can increase or maintain muscle flexibility and strength (Syahrim et al., 2019; Bassile & Hayes, 2015). Joint movement training or ROM is one program to improve the function of stroke patients. ROM is exercise to maintain or increase the ability to move joints naturally to increase muscle mass and muscle tone and stimulation

because the more motor units involved, the more muscle strength will also increase the mobilization ability of post-stroke patients (Bakara & Warsito, 2016). (Sudarsih, 2022).

Form from training *Range Of Motion* This is functional hand training (Power Grip). One form of exercise*Power Grip* is*Cylindrical Grip* which is a functional hand exercise by holding a cylindrical object such as a glass, bottle, rolled tissue in the palm of the hand (Kleim & Jones, 2008 in Soloman, 2013).*Cylindrical Grip* for stroke patients, it is useful for increasing the client's independence and increasing muscle strength. Movement training can also be useful for improving muscle tone and tendon reflexes (Arif & Hanila, 2015). Procedure from Cylindrical Grip means the fingers are folded with the thumb bent over the index finger of the middle finger. This involves function, especially the function of the flexor digitorium profundus. The flexor digitorium sublimis and interosseous muscles help when the strength required is greater (Nursalam, 2008 in Poppy Irawati, et al, 2016). This research is in line with research by Prok Winona., et al. 2016 which conducted research with 18 respondents who were given Power Grip therapy with the Spherical Grip Type where patients were given active movement exercises, namely holding a rubber ball for 1 month, then muscle strength was measured using a Handgrip Dynamometer. The results of the study showed that there was a significant effect of gripping the ball on hand muscle strength (p=0.000). Based on the background that has been explained, researchers are interested in conducting research by providing Cylindrical Grip Exercise therapy to post-stroke patients who experience hemiparesis to train the grip muscles.

METHODS

This research used Pre-Experimental design with One Group Pretest and Posttest approach. This design also does not have a comparison group (control) but at least a first observation (pre test) has been carried out which allows researchers to test changes that occur after the experiment (Setiadi, 2013). Population is a generalization area consisting of objects/subjects that have certain qualities and characteristics determined by researchers to be studied and then conclusions drawn from the population are not just the number of objects or subjects studied, but include all the characteristics or traits possessed by the object or subject (Setiadi, 2013). The population is the entire research object or objects studied (Notoadmojo, 2010). The population in this study were all post-stroke patients in the inpatient ward who experienced paralysis of the upper right/sinistra extremities at Siti Hajar Hospital. In this study, the sample was stroke sufferers with upper extremity hemipharrhea who were treated in the inpatient ward of Siti Hajar Hospital with the following inclusion criteria: 1) Patients who experience hemipharese of the upper extremities, 2) The patient is in a state of compos mentis consciousness, 3) The patient is in a stable TTV condition, 4) Patients who have muscle strength 2-4, 5) Patients aged 45 – 70 years. The exclusion criteria were: 1) Vital signs are unstable, 2) The patient experienced other complaints so he could not continue therapy, 3) Patients with muscle strength 0 and 5, 4) The patient refused to be a respondent. In this study, to obtain a representative sample, researchers used Non-Probability Sampling with Consecutive Sampling technique which were done by determining subjects who meet the research criteria to be included in the research for a certain period of time so that the required number of clients is met (Nursalam, 2014). This research was conducted at the Siti Hajar Hospital Sidoarjo Inpatient Hospital in June – August 2023.

RESULTS

The research results obtained by researchers during the research are as follows:

4.1.1 Respondent characteristics

The results of general data observations of respondents in this study were based on gender, age, hemiparase, education, history of hypertension

Table 4.1: Frequency Distribution of Respondents Based on Gender

Gender	Frequency	Presentase (%)
Man	18	60
Woman	12	40
Total	30	100

Most of the respondents were male, 18 respondents (60%) and 12 respondents (40%) were female.

Table 4.2: Frequency Distribution of Respondents Based on Age

Age (Years)	Frequency	Presentase (%)
Late Adult 36-45 yrs	3	10
Early Elderly 46-55 yrs	12	40
Late Elderly 56-65 yrs	9	30
Seniors 65 and over	6	20
Total	30	100

Most respondents were aged 46-55 years, namely 12 people (40%). 9 respondents aged 56-65 years (30%), 6 respondents aged 65 years and over (20%) and the least aged 36-45 years were 3 respondents (10%).

Table 4.3: Frequency Distribution based on Last Education

Last education	Frequency	Presentase (%)
SD	12	40
JUNIOR HIGH SCHOOL	15	50
SMA	3	10
Total	30	100

Most of the respondents had a junior high school education, namely 15 respondents (50%), 12 (40%) respondents had an elementary school education and the least was a high school education, 3 respondents (10%).

Table 4.4: Frequency Distribution of Respondents based on History of Hypertension

History of Hypertension	Frequency	Presentase (%)
< 2 years	13	43,3
>2 years	17	56,7
Total	30	100

Most respondents had a history of hypertension for more than 2 years, namely 17 respondents (56.7%).

Table 4.5: Frequency Distribution of Respondents based on location of upper extremity hemiparesis

Location of Hemiparesis	Frequency	Presentase (%)
Right	18	60
Skin	12	40
Total	30	100

Most of the respondents, namely 18 people (60%), experienced hemiparesis of the right upper extremity.

Table 4.6: Frequency Distribution of Respondents before Cylindrical Grip Exercise therapy was assessed using the Handgrip Dynamometer

Pre Test	Frequency	Presentase (%)
Weak	23	76,7
Normal	6	20,03
Strong	1	3,3
Total	30	100

Most respondents had finger grip muscle strength in the weak category, 23 respondents (76.7%)

Table 4.7: Frequency Distribution of Respondents after Cylindrical Grip Exercise Therapy was assessed using the Handgrip Dynamometer

Post Test	Frequency	Presentase (%)
Weak	15	50,02
Normal	8	26,7
Strong	7	23,3
Total	30	100

Most respondents had finger grip muscle strength in the weak category, 15 respondents (50.02). This number decreased after the intervention.

Table 4.8: Effect of Cylindrical Grip Exercise Therapy on Finger Grip Muscle Strength in stroke patients

Finger Grip Muscle Strength	Pre Test		Post Test		P value
	F	%	F	%	
Weak	23	76,7	15	50,02	
Normal	6	20,03	8	26,7	0,000
Strong	1	3,3	7	23,3	
Total Respondents	30	100	30	100	

Pre and Post data were carried out using the Paired T Test, the result was a P Value of 0.000, where the results showed <0.05, so it was stated that H1 was accepted and H0 was rejected, which means that there is an effect of Cylindrical Grip Exercise Therapy on Finger Grip Muscle Strength in post-stroke patients.

DISCUSSION

The research results showed that of the 30 respondents, the majority of respondents were aged 46-55 years, 12 respondents (40%). Wahyuningsih's research (2017) shows that the majority of respondents were aged 45-59 years, namely 18 respondents (64.2%), this age is vulnerable to stroke because at this age the blood vessels are no longer elastic and there is a buildup of flakes in the blood vessels due to lifestyle. which is unhealthy. This results in the oxygen supply to the brain being disrupted, which can trigger a stroke (Kozier, 2009). So it can be concluded that age influences the incidence of stroke. According to research by Yunita, 2018 from Handgrip strength requires a combination of actions from a number of hand and forearm muscles, and this action is very important for many daily activities.2 Handgripstrength is a method commonly used to estimate upper extremity muscle strength. Setiati et al3 reported the number of patients with low hand grip strength of 8% and limited mobility of 2.8% from 251 geriatric outpatients. In this study it was found that age correlated with muscle strength as assessed by the hangrip test. One of the consequences of aging is the loss of muscle mass, strength and function beyond control. Muscle mass decreases by approximately 3-8% per decade after the age of 30 years and this rate of decline occurs more rapidly after the age of 60 years. So that increasing age is correlated with a decrease in muscle strength and mobility with a weak correlation.

The research results showed that the majority of respondents were male, namely 18 respondents (60%). The results of Basic Health Research data (2018) state that men are more susceptible to stroke

than women. This is due to reasons, one of which is an unhealthy lifestyle such as smoking, eating fast food and lack of exercise. This is in line with research that has been carried out, because apart from stroke risk factors such as a history of stroke, hypertension, cardiovascular disease, unhealthy lifestyle (smoking, eating fast food, lack of exercise). Cigarettes can cause plaque to build up, resulting in arteriosclerosis. Apart from that, men also act as heads of families who work physically, so as heads of families who carry heavy burdens, they are often stressed about household needs and this contributes to the occurrence of strokes, based on the opinion of Junaidi (2011).) which states that stress can trigger the release of hormones which, if not controlled, can cause hypertension, which causes thick blood to flow into the brain's vascular system and can result in rupture of blood vessels. Several studies show similar results, in the sense that men suffer more strokes than women, such as previous research conducted by Handayani (2012) which showed results of 62 respondents (68.9%) men and 28 respondents (31.1%) woman suffers a stroke. Wahyuningsih's research (2017) also showed that 15 respondents (53.6%) men and 13 respondents (46.4%) women suffered stroke. It can be concluded that the male gender is more at risk of suffering from stroke. In the Putri 2023 research, it was revealed that in 2019 the highest number of stroke cases was in the 50-59 year age group with 16,451 cases. In 2020, the highest stroke cases were in the 60-69 year age group with 9,963 cases. In 2021, the highest stroke cases were in the 60-69 year age group with 10,149 cases (SI PTM Surveillance, 2019, 2020, 2021). distribution of stroke cases according to gender in East Java from 2019 to 2021. The results show that in 2019, the highest number of stroke cases was in males with 25,687 cases, while in females there were 18,940 cases. In 2020, the highest number of stroke cases in women was 15,969 stroke cases, while in men there were 15,514 stroke cases. In 2021, the highest number of stroke cases in women was 16,194 stroke cases, while in men there were 15,721 stroke cases. In 2019 to 2020, stroke cases decreased, but in 2020 to 2021 there was an increase in cases (Putri 2023). In research conducted by Putrawan, 2011 which examined the factors that determine grip muscle strength. In this study it was explained that in this study it was found that men had higher hand grip strength than women. These results are in accordance with those obtained in previous research, where men had significantly higher hand grip strength than women ($t = 19.5$; $p < 0.001$). The difference in hand grip strength between men and women can be explained by the large difference in muscle mass between men and women. 8 Women had significantly lower strength per cm2 of arm muscle area ($t = 14.28$; $p < 0.001$). Differences in hand grip strength based on gender were not fully explained by muscle mass as women had significantly lower strength. pe cm2 arm muscle area. This is in line with the research results that male respondents had changes in grip muscle strength from normal to strong and from weak to normal. So it can be concluded that gender influences the risk of stroke and gender also influences grip muscle strength because the muscle mass of men and women is different.

The results of the study proved that there was a change in the value of finger grip muscle strength before and after Cylindrical Grip ROM exercise therapy. The majority of respondents had finger grip muscle strength in the weak category, 23 respondents (76.7%) after being given therapy, different results were obtained, namely the majority of respondents had finger grip muscle strength in the weak category, 15 respondents (50.02). This number decreased after the intervention. Muscle are active movement tool. Muscle strength is the ability of muscles to contract and produce style.

There is Many things can affect muscle strength such as surgery, injury or certain diseases. Being lazy about exercising can also reduce muscle strength which can make you susceptible to injury during activities. From the data from the literature analysis, it proves the truth of the theory regarding the increase in muscle strength in stroke sufferers who experience muscle weakness after being given cylindrical grip ROM intervention, where active ROM exercises have the benefit of maintaining or increasing muscle strength. One of the movement exercises that can be applied to stroke sufferers is the active cylindrical grip ROM, this exercise can train hand muscle strength and is done in 3 stages, namely opening the hand, closing the fingers to grasp objects, and adjusting grip strength (Irfan, 2010). This theory is also supported by research by Wahyuningsih (2017) which shows that there is a difference in muscle strength before and after being given the intervention where the respondent's muscle strength before the intervention was at grade 3 and after the intervention was carried out for 7 days 2 times the treatment increased muscle strength by 17 (60 .7%) with a muscle strength degree of 5, as many as 10 (35.7%) with a muscle strength degree of 4 and as many as 1 (3.6%) with a muscle strength degree

of 3. Based on the results of literature analysis, there was an increase in muscle strength values in patients after being given ROM Cylindrical Grip intervention. So it can be concluded that the muscle strength values in stroke patients have increased after being given the Cylindrical Grip ROM intervention.

The results of this study prove that there was a change in the value of finger grip muscle strength before and after cylindrical grip exercise therapy. Pre and Post data were carried out using the Paired T Test, the result was a P Value of 0.000, where the results showed <0.05, so it was stated that H1 was accepted and H0 was rejected, which means that there is an effect of Cylindrical Grip Exercise Therapy on Finger Grip Muscle Strength in post-stroke patients. Providing training*range of motion cylindrical grip* For stroke sufferers, it can help increase muscle strength.*Cylindrical grip* is one method of providing physiotherapy therapy, exercises with ROM*cylindrical grip* can increase muscle strength and improve muscle tone in stroke patients (Irawan, 2014).*Cylindrical grip* is one of*power grip* which uses a cylindrical object whose function is to move the fingers of the hand to grasp perfectly (Irfan, 2010). Providing Active ROM exercises*cylindrical grip* can help develop ways to compensate for paralysis through the use of muscles that still have normal function, help maintain, build strength, and control the scars affected by muscles and help maintain ROM in influencing limbs in preventing muscles from shortening (contouring) and disability. Patients with non-hemorrhagic stroke are given therapy*cylindrical grip* because with movement training the muscles will mobilize. Muscle mobilization will prevent muscle stiffness, if therapeutic*cylindrical grip* If done regularly, it helps the process of developing hand motor skills. Various studies show*cylindrical grip*, the fingers are folded with the thumb bent above the index finger of the middle finger. This involves function, especially the function of the flexor digitorium profundus. The flexor digitorum sublimis and interosseous muscles assist when greater force is required. The interosseous is important for providing metacarpophalangeal flexion such as retraction and rotation of the phalanges to adjust the flexor pollicis longus and thenars to be equally active. (Mardati & Setyawan, 2014). According to Wahyuningsih (2017) regarding influence*range of motion aktif cylindrical grip* The results showed that there were differences in muscle strength before and after being given active ROM intervention*Cylindrical grip* (P: 0.001) from the results of this study it can be concluded that ROM is active*Cylindrical grip* effective in increasing upper limb muscle strength. Irawati's research (2016) shows that the effectiveness of training influences*range of motion cylindrical grip* on increasing upper extremity muscle strength in non-hemorrhagic stroke patients (P: 0.000), which means that there is an effect of exercise*range of motion cylindrical grip* on increasing upper extremity muscle strength in non-hemorrhagic stroke patients. In line with Ariastuti's (2017) research, the results of the study stated that there were differences in muscle strength before and after being given the Cylindrical grip ROM intervention (P: 0.001). From the results of this study it can be concluded that the Cylindrical grip ROM is effective in increasing upper extremity muscle strength.

CONCLUSION

The results of this research can be concluded that of the 30 respondents, the majority were male, namely 18 respondents and the majority were in the 46-55 year age range, 12 respondents. The pretest results before the cylindrical grip exercise therapy was carried out were mostly in the weak category with 23 respondents and after the cylindrical grip therapy intervention was carried out, the weak category decreased to 15 respondents and the normal category became 8 respondents and the strong category was 7 respondents. However, if you look at the measured values or numbers of the Handgrip dynamometer, the results show a significant change in values after therapy. Cylindrical Grip Exercise Therapy on finger grip muscle strength has a significant influence with a p value of 0.000.

SUGGESTION

Hospitals can use the results of this research as a basis for creating SOP for cylindrical grip therapy and can carry out this intervention to increase finger grip muscle strength in post-stroke patients. Nurses can use this therapy as a therapeutic therapy for post-stroke patients who experience upper extremity hemiparesis. This research can be used as a reference

or literature source and can be used as teaching material for the subject in question.

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CONFLICTS OF INTEREST

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AUTHOR CONTRIBUTIONS

In this research, the main author acts as a correspondent who is responsible for the research process, from conception to publication by writing articles that have been adapted to journal guidelines. The main author also played a role in literature search, data analysis, translation and the research process, but in data collection the main author was assisted by a research assistant, namely one student.

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