





Review

Effectiveness of the Application of Range of Motion (ROM) with the Cylindrical Grip Method on Increasing Upper Extremity Muscle Strength in Non-Hemorrhagic Stroke Patients: A Systematic Review

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ARTICLE INFO	ABSTRACT
<p>Article History Submit : Dec 23, 2024 Revised : Dec 27, 2024 Accepted : Dec 27, 2024</p> <p>Keywords: ROM, Cylindrical Grip, Stroke</p>	<p>Background: <i>The Ministry of Health revealed that in 2023, stroke cases will increase, and funding for stroke will be very large, causing other diseases. Therefore, patients must carry out the cylindrical grip method independently without large costs.] This study aims to assess the effectiveness of applying Range of Motion (ROM) exercises using the Cylindrical Grip method to enhance upper extremity muscle strength in non-hemorrhagic stroke patients.</i></p> <p>Methods: <i>A literature review was carried out using PRISMA flow diagrams. The journal databases used are Google Scholar and Scopus. Inclusion criteria include articles that focus on the effect of the cylindrical grip method on non-hemorrhagic stroke patients, journals for the last 5 years, full pdf access, the exclusion criteria are research articles of the review type.</i></p> <p>Results: <i>The search results obtained 10 journals by searching two databases: Google Scholar and Scopus</i></p> <p>Conclusion: <i>The cylindrical grip method significantly increases muscle strength in non- hemorrhagic stroke patients and can be used as a gradual mobilization method that can be carried out at home independently by the patient.</i></p>
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Introduction

According to World Health Organization data, there are more than 12 million new cases of individuals who have had a stroke each year with the latest cases. In Indonesia, stroke is the main cause of death (Feigin et al., 2021). According to the results of Riskesdas 2018, the prevalence of stroke in Indonesia increased from 7 per 1,000 population in 2013 to 10.9 per 1,000 population in 2018. The 2019 Basic Health Research by the Ministry of Health of the

Republic of Indonesia estimated that the number of stroke sufferers in the country, based on diagnoses by healthcare workers (Nakes), was 1,436,925 people (0.7%). Additionally, the number of individuals with stroke symptoms or diagnoses was estimated at 2,237,941 people (12.1%). Stroke patients in East Java Province according to Basic Health Research in 2019 reached 22,120 people or 12.4% and ranked 8th in Indonesia (Kemenkes RI, 2021). In terms of healthcare financing,



stroke is one of the most costly diseases, ranking third after heart disease and cancer, with expenditures reaching 3.23 trillion rupiah in 2022. This figure represents an increase compared to 2021, when the cost was 1.91 trillion rupiah ([Boehme et al., 2017](#)).

Non-hemorrhagic stroke according to Bill & Foundation, 2021 in his journal revealed that globally in 2019 the largest prevalence of stroke was non-hemorrhagic stroke as much as 62.4% (7.63 million), then intracerebral hemorrhage stroke reached 27.9% (3.41 million) and subarachnoid hemorrhage stroke amounted to 9.7% (1.18 million). Non-hemorrhagic stroke is the most common type of stroke with an incidence rate of 87% while hemorrhagic stroke is 13%. The incidence of ischemic stroke is more common in men than women ([Azizah & Anam, 2024](#)).

Non-hemorrhagic stroke is most commonly found due to causative factors related to high blood pressure, diabetes mellitus (DM), high cholesterol, smoking, alcohol consumption, atrial fibrillation, obesity and lack of physical activity. Stroke can be divided into two types: hemorrhagic and non-hemorrhagic. Hemorrhagic stroke is bleeding that enters the brain tissue or enters the subarachnoid space caused by a ruptured blood vessel and results in bleeding. Meanwhile, non-hemorrhagic stroke, commonly referred to as ischemic stroke, is caused by blockage of the cervical artery or cerebral artery, resulting in the death of brain tissue due to impaired blood flow in the brain ([Waruwahang et al., 2023](#)). Non-hemorrhagic stroke causes brain damage on certain sides called hemiparesis (partial paralysis) ([Mahyuvi & Nursalam, 2020](#)).

Hemiparesis is caused by damage to Brodmann areas 4-6, which are responsible for motor control. This condition reduces

motor function, particularly in the upper extremities, resulting in a lack of impulses reaching the fingers, thereby reducing muscle strength in the hand. Severe muscle weakness in non-hemorrhagic stroke patients can be addressed through non-pharmacological interventions. Range of Motion (ROM) training is one such intervention to improve muscle strength. ROM exercises, also known as joint movement exercises, promote active muscle contractions and movements, helping to restore motor function ([Setyawati & Retnaningsih, 2024](#)).

One commonly used method in the rehabilitation of non-hemorrhagic stroke patients is Range of Motion (ROM) exercises with the Cylindrical Grip technique. This exercise involves functional hand movements where the patient grasps a cylindrical object, with the fingers curled and the thumb positioned over the index and middle fingers. It engages the flexor digitorum profundus (muscles of the forearm, fingers, and hands), the flexor digitorum superficialis (the middle muscle on the anterior side of the forearm), and the interosseous muscles (small muscles responsible for squeezing and pinching). These muscles work together to provide the necessary strength for gripping and holding the object ([Hapsari et al., 2020](#)).

Research shows that the ROM cylindrical grip exercise effectively increases the strength of the upper extremity muscles of non-hemorrhagic stroke patients. Seeing that stroke cases are increasing and financing stroke is very large, the author is interested in researching to conduct a further research literature review on the effectiveness of ROM Cylindrical Grip exercise as one of the non-pharmacological treatments that can be done in non-hemorrhagic stroke patients during the rehabilitation period without having to spend a lot of money, and can be

used as a gradual mobilization exercise that can be done independently at home (Syikir et al., 2020).

Methods

Eligibility Criteria

The author will entirely filter the article from the selected references based on the title and year range, so that more relevant articles are obtained. The author then determines the inclusion and exclusion criteria. Inclusion criteria 1. Journal from 2019-2024, 2.Non-Hemorrhagic Stroke Patients 5. Cylindrical Grip ROM Exists, 6.Full Access PDF . Exclusion Criteria. : 1. Articles that do not match the title 2. Articles in the form of Literature Review and the like that fall under the inclusion criteria are made in the form of the DSVIA

method by the author and database search is obtained in PRISMA .

Information Sources & Search Strategy

The research method used by the author is the systematic review preparation method. The author starts by determining the title's topic, the literature review's purpose, and the keywords to search for the journal. The author searches for journal databases through Google scholar and Scopus,. The keywords are "Range Of Motion", "Clyndrical Grip", "Non-Hemorrhagic Grip".

Selection Process

This research article uses a systematic review design with standard systematic review (PRISMA) used to conduct a systematic review.

Results

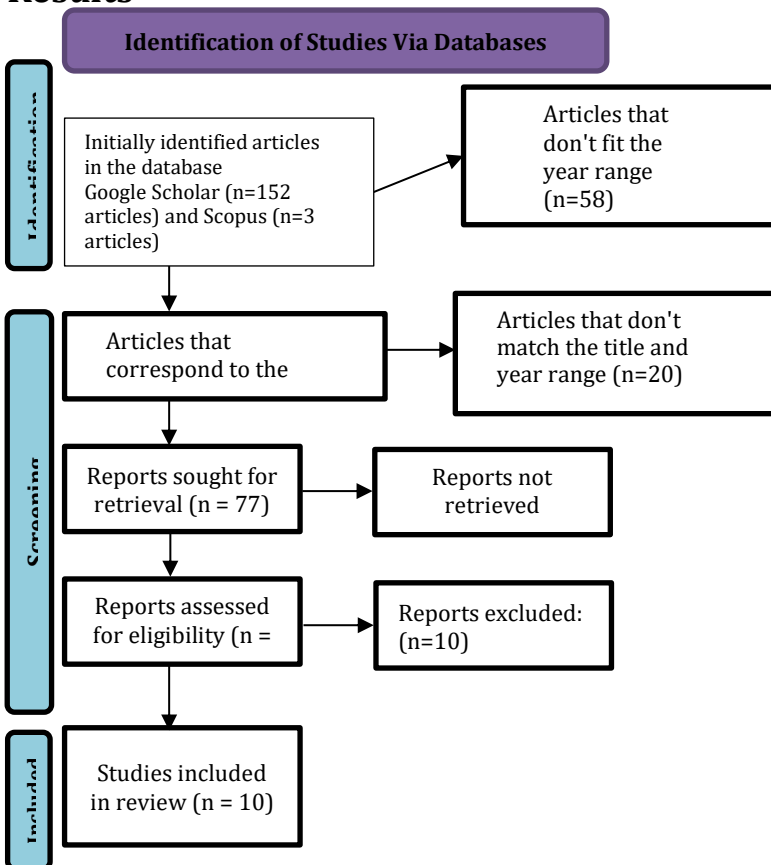


Figure 1. Flowchart PRISMA

Table 1. Characteristic Study

No.	Article Title; Writer; Year	Methods (Design, Samples, Variables, Instrumentss, Analysis)	Research Results
1	<p>Asuhan Keperawatan Pasien Stroke Non Hemoragik dengan Penerapan Latihan ROM Aktif Cylindrical Grip Terhadap Kelemahan Otot Ekstremitas Atas dengan Masalah Gangguan Imobilitas Fisik di Ruang Lantai 6 Rumah Sakit Husada Utama Surabaya (Farikesit et al., 2023).</p>	<p>Desain Case study.</p> <p>Sample Research 2 non-hemorrhagic stroke patients (Mrs. A and Mrs. B) with a diagnosis of physical mobility disorders were treated on the 6th floor of Husada Utama Hospital Surabaya.</p> <p>Variable 1. Variable Independent: ROM Workout is active using cylindrical grip. 2. Dependent Variable: Strength of the patient's upper extremity muscles.</p> <p>Research Instruments 1. Patient interviews. 2. Physical examination. 3. Observation. 4. Documentation.</p> <p>Data Analysis Evaluation is carried out through observation directly to changes in muscle strength and limb movement after 5 days of therapy (2 times a day for 15 minutes).</p>	<p>The patient has weakness of the left upper extremity with scale muscle strength 3. After 5 days of cylindrical grip training, the results show Increased muscle strength, upper limb movement, Limited movement and reduced physical weakness.</p>
2	<p>The Effectiveness of Range Of Motion Cylindrical Grip Exercise on Increasing Upper Extremity Muscle Strength in Non-Hemorrhagic Stroke Patients in the Inpatient Room of Tangerang Regency Hospital (Irawati et al., 2021)</p>	<p>Design Quasi-experiment with <i>one group pretest-posttest design</i>.</p> <p>Sample A total sample of 24 non-hemorrhagic stroke patients at the Tangerang Regency Hospital. The sampling technique uses <i>total sampling</i> (sample is the same as the population).</p> <p>Variable Independent variable: <i>Range of Motion</i> (ROM) training using cylindrical grip. Dependent variable: Upper extremity muscle strength.</p> <p>Instruments</p>	<p>Based on the Paired Sample t-test, a p-value of 0.00 was obtained, indicating that the Range of Motion cylindrical grip exercise effectively enhances upper extremity muscle strength in non-hemorrhagic stroke patients. Most patients who adhered to the exercise regimen demonstrated a significant improvement in muscle strength</p>



No.	Article Title; Writer; Year	Methods (Design, Samples, Variables, Instrumentss, Analysis)	Research Results
		<p>Muscle strength measurements were performed before and after the ROM cylindrical grip exercise intervention.</p> <p>Data Analysis Statistical test using the Paired Sample t-test.</p>	
3	<p>The Effectiveness Of Range Of Motion Cylindrical Grip Exercise On Upper Extermity Muscle Strength In Non-Hemorric Stroke Patients In The Nervous Room RSUD Jend . Ahmad Yani Metro (Eva Agustina et al., 2021)</p>	<p>Design Case studies</p> <p>Sample Two patients with a diagnosis of non-hemorrhagic stroke who experienced weakness in the upper extremities were included in the study.</p> <p>Variable Independent Variable: Range of Motion (ROM) training with the Cylindrical Grip method. Dependent variable: Increased upper extremity muscle strength in stroke patients.</p> <p>Instruments Muscle strength observation sheet, tissue roll, and Standard Operating Procedure (SOP) for ROM Cylindrical Grip training</p> <p>Analysis Data was collected through observation of muscle strength before and after applying ROM training for three days, with muscle strength measurements using an observation scale.</p>	<p>In subject I, the strength of the right hand muscles increased from 2 before therapy to 3 after three days of applying the ROM Cylindrical Grip exercise. The strength of the left hand muscles remained stable at a value of 5. In subject II, the right hand's muscle strength increased from 1 to 2 after three days of therapy, while the left hand remained at a value of 5. The ROM Cylindrical Grip exercise consistently increased the strength of the right hand muscles in both subjects, although no change in the left hand already had maximum muscle strength. This therapy It is recommended for the patient's family to be carried out independently to help rehabilitate non-hemorrhagic stroke patients who experience muscle weakness. ROM exercises with the Cylindrical Grip method effectively increase the strength of the upper extremity muscles in non-hemorrhagic stroke patients. The application of this technique is simple and can be done independently by the patient's family to help the recovery process.</p>
4	<p>Application Of Active Rom (Cylindrical Grip) To Increasing Upper Extremity Muscle Strength In Non-Hemorrhagic Stroke Patients (Choirunnisya et al., 2023)</p>	<p>Desain Case studies to evaluate application of Cylindrical Grip active ROM in increasing strength muscles of non-hemorrhagic stroke patients.</p> <p>Sample Two non-hemorrhagic stroke patients who experienced hemiparesis weakness) in the nerve room of Jend. Ahmad Yani Metro Hospital in 2022. Subject inclusion criteria include patients with muscle strength scale 0-3, fully</p>	<p>In subject I, the muscle strength of the right hand before application was 1, and the left hand 5. After three days of applying the Cylindrical Grip active ROM exercise, the muscle strength of the right hand increased to 3, while the left hand remained stable at 5. In subject II, the muscle strength of the right hand was initially at 2, and the left hand 5. After three days of application, the muscle strength of the right hand increased to 3, while the left hand remained at 5. The results showed that applying Cylindrical Grip's active ROM effectively increased the strength of the weaker right hand muscles. In contrast, the strength of the left hand did not change significantly because</p>



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		<p>conscious (compos mentis), willing to be a respondent, and without age restrictions.</p> <p>Variable Independent Variable: Cylindrical Grip active ROM training. Dependent variable: Upper extremity muscle strength in non-hemorrhagic stroke patients.</p> <p>Instruments Muscle strength observation sheets are used to measure changes in muscle strength before and after applying the active ROM of the Cylindrical Grip.</p> <p>Analysis Muscle strength was observed before and after the application of the active ROM of the Cylindrical Grip for three consecutive days.</p>	<p>the muscle strength was maximized from the beginning. The application of Cylindrical Grip active ROM has been proven effective in increasing the strength of the upper extremity muscles in non-hemorrhagic stroke patients, especially in weakened limbs (hemiparesis).</p>
5	<p>Implementation Of Active Cylindrical Grip Range Of Motion (ROM) On Muscle Strength In Non-Hemorrhagic Stroke Patients (Rafudin et al., 2024)</p>	<p>Design This study uses a case study design.</p> <p>Subject The study subjects consisted of two non-hemorrhagic stroke patients who were selected according to the inclusion criteria.</p> <p>Variable Dependent variable: Muscle strength of stroke patients. Independent Variable: Application of cylindrical grip active ROM exercise.</p> <p>Instruments The instruments used included questionnaire sheets for subject characteristics, standard operating procedures (SPO) for cylindrical grip active ROMs, and observation sheets to measure muscle strength using Camry ISO 9001 brand handgrip dynamometers.</p> <p>Analysis Data analysis was conducted using descriptive analysis, which involved comparing muscle strength before and after the exercise application.</p>	<p>The results indicated that the application of active ROM cylindrical grip exercises for 7 days, with a frequency of 2 sessions per day for 10 minutes, successfully increased muscle strength in both subjects. Subject I's muscle strength improved from 16.2 kg to 19.0 kg, while Subject II increased from 29.5 kg to 34.5 kg. These findings demonstrate that regular, consistent application of active ROM exercises can effectively enhance muscle strength in non-hemorrhagic stroke patients.</p>
6	<p>Efektifitas Rom Cylindrical Grip</p>	<p>Design</p>	<p>The results showed that before the intervention, 12 out of 17</p>



No.	Article Title; Writer; Year	Methods (Design, Samples, Variables, Instrumentss, Analysis)	Research Results
	<p>Terhadap Peningkatan Kekuatan Otot Tangan Pada Pasien Stroke Non Hemoragik (Mardiana et al., 2021)</p>	<p>This study uses a quasi-experimental research method with a Pre-Post Test approach.</p> <p>Subject The study subjects consisted of 34 non-hemorrhagic stroke patients from RAA Soewondo Pati Hospital, divided into two groups: 17 patients in the intervention group and 17 patients in the control group. These participants were selected using the consecutive sampling technique.</p> <p>Variable Dependent Variable: The strength of the patient's hand muscles. Independent Variable: Application of cylindrical grip ROM exercise.</p> <p>Instruments The instruments used were questionnaires for the characteristics of the subjects and the measurement of hand muscle strength using standard measurement methods (e.g., handgrip dynamometer).</p> <p>Analysis Data were analyzed using the Wilcoxon signed-rank test to determine the significant difference in muscle strength measurements before and after the intervention.</p>	<p>respondents (70.6%) had good hand muscle strength, while after the intervention, 16 respondents (94.1%) showed improvement. Regarding abduction strength, 13 respondents (76.5%) had good muscle strength before the intervention, and this increased to 15 respondents (88.2%) after the intervention. The analysis yielded a p-value of 0.000, indicating a significant effect of the ROM cylindrical grip exercise on improving hand muscle strength in non-hemorrhagic stroke patients.</p>
7	<p>Efektivitas Range of Motion (ROM) Aktif-Asistif: Spherical dan Cylindrical Grip Terhadap Kekuatan Otot Pasien Stroke (Liza et al., 2022)</p>	<p>Design This study is a quantitative research with a Quasi Experimental pre-post test design. This design aims to find the effect of certain treatments on others by providing pretest before and posttest after the intervention.</p> <p>Subject The study respondents comprised 32 stroke patients divided into two groups, each comprising 16 people. One group received spherical grip therapy, while the other received cylindrical grip therapy. All respondents were patients undergoing therapy in the physiotherapy room of Dr. M. Yunus Hospital, Bengkulu Province.</p> <p>Variable The dependent variable in this study was the strength of the upper</p>	<p>This study shows that active-passive ROM therapy using spherical grips and cylindrical grips effectively increases the strength of stroke patients' upper extremity muscles.</p>



No.	Article Title; Writer; Year	Methods (Design, Samples, Variables, Instrumentss, Analysis)	Research Results
		<p>extremity muscles, while the independent variable was active-assisted ROM therapy using spherical grip and cylindrical grip techniques.. Instruments The instrument used in this study is a questionnaire that measures the strength of upper extremity muscles before and after therapy. Analysis Data analysis involved both univariate and bivariate analyses, with the Wilcoxon signed-rank test used to determine the significance of the effect of therapy on upper extremity muscle strength.</p>	
8	<p>Penerapan Range of Motion Cylindrical Grip Terhadap Kekuatan Otot Ekstremitas Atas Dengan Stroke Non Hemoragik (Yuliasani et al., 2023)</p>	<p>Design This study uses a descriptive case study design to evaluate the application of Cylindrical Grip ROM therapy in patients with non-hemorrhagic stroke. Subject The study subjects consisted of two respondents who experienced non-hemorrhagic stroke, met the inclusion criteria, namely cooperative and willing to be respondents, and had a history of non-hemorrhagic stroke and upper extremity muscle weakness. Respondents who were uncooperative or refused to participate were excluded from the study. Variable Dependent Variable: Upper extremity muscle strength. Independent Variable: Application of Cylindrical Grip ROM therapy. Instruments The instruments used in this study are Manual Muscle Testing (MMT) and Standard Operating Procedure (SOP) for ROM Cylindrical Grip. Analysis The analysis was conducted by comparing muscle strength before</p>	<p>The results showed increased muscle strength in both respondents after applying ROM Cylindrical Grip therapy.</p>



No.	Article Title; Writer; Year	Methods (Design, Samples, Variables, Instrumentss, Analysis)	Research Results
		and after applying Cylindrical Grip ROM therapy. The therapy was administered over three consecutive days, with two daily sessions. Each session consisted of seven gripping repetitions, each lasting 5 seconds, followed by a 5-second pause.	
9	The Effect of Cylindrical Grip ROM Exercise Therapy on Finger Grip Muscle Strength in The Upper Extremities of Post-Stroke Patients (Pratiwi , 2023)	<p>Design Pre-Experimental Design with One Group Pretest and Posttest approaches.</p> <p>Sample Using Probabilit Sampling with Consecutive Sampling Technique</p> <p>Variable Independent variable : Cylindrical grip exercise therapy Dependent variable: Strength of the finger grip muscles in post-stroke patients</p> <p>Instrument Using the Dynamometer Handgrip Tool</p> <p>Analysis Using the Paired T-Test to assess differences in muscle strength before and after the intervention</p>	Before the intervention, most patients with muscle strength were categorized as weak. However, after the intervention, there was a notable improvement in muscle strength, with a decrease in the number of respondents in the weak category and an increase in those categorized as normal and strong.
10	Effect of Combination Mirror Therapy and Cylindrical Grip on Self-Care of Post- Stroke Ischemic Patients (Aridamayanti et al., 2020)	<p>Design Quasi-eksperimental (pre-post test with control group design)</p> <p>Sample A sample of 66 respondents (33/33) was selected by purposive sampling.</p> <p>Variable The independent variable combines mirror therapy and cylindrical grip exercises, while the dependent variable is self-care.</p> <p>Instrument This study uses a questionnaire</p> <p>Analysis</p>	These two combined therapies can stimulate the coordination of upper limb movements by targeting sensory and motor nerves, which enhances the patient's ability to perform self-care tasks after a stroke. This improvement is reflected in muscle strength, range of motion, and finger mobility, ultimately contributing to the gradual restoration of physical function.



No.	Article Title; Writer; Year	Methods (Design, Samples, Variables, Instrumentss, Analysis)	Research Results
		The analysis was conducted using the Kolmogorov-Smirnov and Wilcoxon Signed Rank tests. The intervention was administered three times a week for one month.	



Discussion

The search for this journal database starts from the author determining the research title then searches for journals related to the title in general and finds 155 journals, namely 152 from Google Scholar and 3 from Scopus. Then the author narrowed the search by adding one keyword for the 2019-2024 range, then by searching according to the year range and title so that there were 77 articles and 1 duplicates. So 56 articles do not match. Among the 77 articles, the researcher searched for inclusion criteria and found 20 full text articles that met the inclusion criteria. However, when the author read the whole it turned out that 6 articles could not be accessed and 2 in the form of a thesis and 1 thesis and 1 final scientific paper. So, the author decided to take 10 articles and move them to Mendeley to organize the selected articles to make it easier for the author to create a bibliography and avoid duplicates. Based on various journals reviewed by the author in this review literature, the author found that range of motion exercises positively affect upper extremity muscle strength in non-hemorrhagic stroke patients. The Cylindrical Grip ROM Exercise is effective in non-hemorrhagic stroke patients because the Cylindrical Grip ROM Exercise involves direct stimulation of the muscles of the hands and arms. The ROM Cylindrical Grip exercise this training activity will involve the movement of grasping cylindrical objects. It will train the muscles to stimulate flexion and extension movements so that the movement can directly stimulate the contraction of the wrist muscles of the arm. As one of the studies from (Farikesit et al., 2023) shows, it shows an increase in muscle strength from a scale of 3 to 4 after five days of exercise (Aridamayanti et al., 2020).

Judging from a case study conducted

by (Agustina et al., 2021) and (Choirunnisya et al., 2023) also shows that this exercise can help improve mobility extremities in patients with physical weakness due to stroke because this Cylindrical Grip exercise makes the hand muscles active so that it can increase the range of motion in patients who experience physical weakness.

This Cylindrical Grip ROM exercise also has the advantage of several other ROM methods reviewed by the author from several journals obtained such as those carried out by (Liza et al., 2022) that Cylindrical Grip ROM is more effective than other methods in increasing muscle strength. This advantage is believed to come from the cylindrical grip technique, which allows the hand muscles to work more optimally and provides greater stability during exercise compared to the spherical grip method or power grip.

On the one hand, this ROM Cylindrical Grip exercise also gives patients luck. ROM Cylindrical Grip can increase the strength of the upper extremity muscles simply as long as the patient performs consistently because ROM Cylindrical Grip can be done independently at home. Therefore, the ROM Cylindrical Grip method is considered suitable for patients to do independently at home as a gradual mobilization process. This is in line with research by Sri Ssika Mardiana 2021 and Adinda Choirunnisa 2023, supporting this method as an easy independent technique for patients and families to support rehabilitation at home (Irawati et al., 2021).

In nursing, the ROM Cylindrical Grip exercise is part of the intervention to overcome the patient's physical mobility problems. This range of motion intervention is listed in SIKI with code I.0800, or "Range of Motion Exercises," which aims to maintain the range of motion of the patient's muscle strength joints. The

Cylindrical Grip ROM exercise is an active ROM where the patient has reached the rehabilitation stage so that the patient can do it on his own without the full assistance of the nurse (Rafiudin et al., 2024).

This rehabilitative action aims to help restore the strength and function of the upper extremity muscles of patients who experience weakness due to stroke, and nursing actions are an important part of rehabilitative nursing interventions aimed at improving mobility and strengthening muscle function of post-stroke patients, such as physical recovery interventions, independence support, education funds to the patient's family.

Conclusion

Range of Motion (ROM) exercises using the cylindrical grip method have proven effective in increasing upper extremity muscle strength in non-hemorrhagic stroke patients. Research indicates a significant improvement in muscle strength following this intervention. ROM exercises with cylindrical grips also help prevent muscle contractures and musculoskeletal disorders resulting from weakness. Therefore, this method can be recommended as an integral part of a rehabilitation program for non-hemorrhagic stroke patients, aiming to enhance upper extremity muscle strength and prevent further complications.

Authors Contributions

Contributed by the author collecting articles on improving muscle strength of the extremity muscles with the Cylindrical Grip method in non-hemorrhagic stroke patients. Exercise with this method also supports neuromuscular recovery and improves motor function in stroke patients.

Conflicts of Interest

There is no conflict of interest.

Acknowledgment

Thank you to the research team for the cooperation in compiling this systematic review. Hopefully it will be useful.

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