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Rubber ball grasping therapy to improve muscle strength in patient with ischaemic stroke

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Abstract
Non-haemorrhagic stroke is one of the most common cardiovascular diseases, leading to death and disability worldwide. Muscle strength in stroke patients is essential for improving quality of life and motor function. Range of Motion (ROM) exercises and pharmacological therapies can help enhance muscle strength in stroke patients. ROM exercises using rubber balls can specifically increase muscle strength in these individuals. This study aimed to analyse the effects of rubber ball grasping therapy on the muscle strength of stroke patients with physical mobility disorders at RSUD Tidar, Magelang City. A case study design was employed, and the research was conducted from September 17 to September 21, 2023. The results indicated an increase in muscle strength, with scores rising from scale 1 to scale 2. Therefore, rubber ball grasping therapy can be utilized as a non-pharmacological intervention for addressing physical mobility disorders in stroke patients.

Keywords: Ball grip therapy; non-haemorrhagic stroke; muscle strength; medical surgical nursing; supporting therapy

Introduction
According to the American Stroke Association (ASA), stroke is a medical condition caused by cerebral circulatory disorders that can result in permanent nerve damage, complications, and death (Powers et al., 2019). In 2024, stroke cases continue to increase globally, making it one of the leading causes of death. A report by the United States Centers for Disease Control (CDC) indicates that the prevalence of stroke has increased by almost 8 percent among young people aged 18-44 years. There has also been an increase of 15.7 percent in the 45-65 year age group (Sulaiman & Anggriani, 2018). In Indonesia, stroke remains a significant health problem in 2024. According to data from the Institute for Health Metrics and Evaluation (IHME) in 2019, stroke is the leading cause of death in Indonesia, accounting for 19.42% of all deaths (Sudarsono et al., 2024). Physical mobility impairment is the inability to perform movements or physical activities freely and without pain or discomfort. This can include decreased muscle strength, balance, ability to move, and the inability to perform daily activities (NANDA, 2018). Managing physical mobility disorders in stroke patients involves several strategies based on proper diagnosis and various therapeutic methods such as range of motion (ROM) therapy, joint strengthening exercises, and rubber ball therapy. Rubber ball grip therapy for stroke patients involves using rubber balls in a repetitive manner to increase hand grip strength. The goal of this therapy is to restore motor function and increase independence in daily activities (Rahmawati et al., 2021). Research by Nurartianti and Wahyuni (2020) shows that ball grasping therapy improves fine motor skills in stroke patients. Their analysis demonstrates significant improvement in fine motor skills before and after ball grasping therapy, conducted twice a day, with values increasing from 20.67 to 35.13 (p-value 0.000 < 0.05). Similarly, research by Rismawati et al. (2022) discusses the application of rubber ball exercise ROM therapy to reduce physical mobility disorders in non-hemorrhagic stroke patients. Their findings show a change in hand/grip muscle strength after therapy, evidenced by improved hand muscle strength. Further research by Khaliri and Waliyanti (2023) indicates that ball grasping therapy is effective in increasing hand muscle strength in elderly stroke patients. The results show that performing ball grasping therapy twice a day for four days, with a duration of 7-10 minutes, effectively increases muscle strength, as evidenced by an improvement in muscle strength values from 3/5 before the intervention to 4/5 after the intervention.

Based on the provided paragraph, several gaps in the existing studies can be identified. Firstly, while Nurartianti and Wahyuni (2020) demonstrated significant improvement in fine motor skills with ball grasping therapy, there is a lack of long-term follow-up to determine if these improvements are sustained over time. Additionally, the studies focused on specific patient demographics, such as stroke patients and elderly stroke patients, leaving a gap in research examining the therapy's effectiveness across different age groups and types of stroke patients (e.g., hemorrhagic vs. non-hemorrhagic). Another gap is the comprehensive measurement of outcomes, as Rismawati et al. (2022) measured changes in hand/grip muscle strength but did not assess other aspects of physical mobility or quality of life. Furthermore, the intensity and duration of therapy were not explored in depth; while Khaliri and Waliyanti (2023)

found improvements with a specific regimen, it is unclear if different schedules might yield better or comparable results. Comparative effectiveness studies are also lacking, as there is a need for research evaluating ball grasping therapy against other therapeutic interventions for stroke patients. Additionally, the underlying mechanisms contributing to the observed improvements in motor skills and muscle strength remain unexplored. Finally, the sample sizes in the studies are not mentioned, raising concerns about the generalizability of the results. Future research should involve larger and more diverse populations to validate the findings. Addressing these gaps can provide a more comprehensive understanding of the effectiveness of ball grasping therapy for stroke patients and potentially improve therapeutic approaches.

Case Description

In this study, an assessment was carried out, including patient identity, medical history, health function patterns, physical examination, supporting examinations, and data analysis. This study involved one patient as a respondent, namely Mr. S. The results of the assessment of Mr. S in the Aster 2 room of TIDAR Hospital, Magelang City, are as follows: Mr. S is 70 years old. Mr. S's main complaint is the weakness and difficulty in moving his left extremity. In performing daily activities, Mr. S is fully assisted by his family. Mr. S experienced weakness in the left upper and lower extremities, with a muscle strength scale of 1. At the time of assessment, Mr. S's vital signs were as follows: blood pressure 179/80 mmHg, temperature 36.8ºC, pulse 78x/min, and respiration 20x/min. Supporting examinations included a radiology CT scan performed on September 17, 2023, revealing lacunar infarction in the right corona radiata, possible leukoaraiosis in the periventricular area bilaterally, and ventriculomegaly in the lateral and third ventricles. Based on these results, a nursing diagnosis of impaired physical mobility associated with decreased muscle strength was established, characterized by Mr. S's complaints of weakness and difficulty in moving the left extremities, decreased muscle strength scale (<5), decreased range of motion, and physical weakness. The planned intervention focused on providing ball grasping therapy for non-haemorrhagic stroke patients. The implementation occurred from September 18-21, 2023, with therapy administered twice daily, in the morning and afternoon, for 15 minutes each session. Muscle strength was assessed before and after each session.

On the first day, September 18, 2023, the morning session began at 08:15 with an initial muscle strength assessment of the left extremity, showing a scale of 1. Ball grasping therapy was then administered for 15 minutes. After the session, Mr. S reported that his left hand remained weak and immobile. The second session at 12:10 was conducted similarly for 15 minutes, with the muscle strength assessment still showing a scale of 1, and Mr. S reporting no improvement. On the second day, September 19, 2023, the morning session at 08:30 started with a muscle strength assessment, showing a scale of 1. Ball grasping therapy was performed for 15 minutes, but Mr. S still reported weakness and immobility. The second session at 12:30 was also 15 minutes long, with the muscle strength assessment still indicating a scale of 1, and Mr. S experiencing no improvement. On the third day, September 20, 2023, the morning session at 08:10 began with a muscle strength assessment, showing a scale of 1. After 15 minutes of ball grasping therapy, Mr. S reported his left hand remained weak, although his fingers had started to move slightly, yet could not fight gravity. The muscle strength assessment showed a scale of 2. The second session at 12:00 involved another 15 minutes of therapy. Mr. S reported slight improvement, with his fingers and wrist beginning to move slowly but still unable to fight gravity. On the fourth day, September 21, 2023, the morning session at 08:30 began with a muscle strength assessment showing a scale of 2. Ball grasping therapy was administered for 15 minutes, after which Mr. S reported decreased weakness in his left hand, with fingers and wrist moving slowly but still not able to fight gravity. The second session at 12:30 involved another 15 minutes of therapy, with Mr. S again reporting reduced weakness, though still unable to fight gravity. The muscle strength assessment still indicated a scale of 2. After four days of consistent ball grasping therapy, twice daily for 15 minutes, the evaluation showed an increase in Mr. S's muscle strength from a scale of 1 to a scale of 2 **(Table 1)**.

Discussion

Mr. S is 70 years old and has increased blood pressure and decreased muscle strength. During the assessment, it was found that Mr. S had weakness in his left extremity with a muscle strength score of 1. From these results, it can be concluded that age is a risk factor for decreased muscle strength. This is in line with research by Leni & Triyono (2018), which explains that with increasing age, physiological changes occur that can affect muscle function, such as decreased production of the hormone testosterone, which affects muscle strength. With increasing age, muscles also undergo structural changes, such as a decrease in the number of myofibrils and an increase in the amount of collagen, which can reduce muscle strength. The assessment also revealed that Mr. S has suffered from hypertension for the past four years. This is consistent with research by Margiyati et al. (2022), which states that hypertension can cause damage to the walls of blood vessels, leading to rupture or narrowing and resulting in stroke. Based on the main nursing diagnosis of physical mobility disorders, one of the interventions taken was rubber ball grasping therapy, aimed at increasing muscle strength in Mr. S. The therapy was implemented for four days, with two sessions of 15 minutes each day. After four consecutive days of therapy, there was an increase in the muscle strength of Mr. S's left upper extremity from the original score of 1. This suggests that rubber ball grasping therapy can increase muscle strength in

stroke patients and help overcome physical mobility disorders. This is in line with research by Azizah and Wahyuningsih (2020), which involved two respondents with partial hemiparesis and showed that after warm-up ball grips for 3-10 minutes, both patients experienced an increase in muscle strength. It can be concluded that ball grasping therapy can help overcome physical mobility obstacles in stroke patients. Additionally, research by Rosaulina (2024) showed that 90% of patients experienced problems with hand muscle strength and 10% had issues with thumb-to-finger coordination. After being given rubber ball grasping therapy, there was an increase in hand muscle strength.

Table 1. Observation during study.

No	Date	Muscle Strength Score	
		Before	After
1	18 September 2023	1	1
2	19 September 2023	1	1
3	20 September 2023	1	2
4	21 September 2023	2	2

After the implementation of rubber ball grasping therapy on Mr. S, a significant increase in muscle strength was observed. The improvement in Mr. S's muscle strength can be seen in the table below. The increase in muscle strength is due to the effect of rubber ball grasping therapy, which enhances muscle strength in the hand, particularly the muscles involved in grasping and moving the fingers, thereby improving motor function and mobility in stroke patients. This aligns with the theory proposed by Christaputri and Anam (2023), which states that rubber ball grasping exercises are effective in increasing muscle strength, neuronal activity, physical mobility, balance, motor strength, and grip strength in stroke patients. Therefore, rubber ball grasping exercises can be an effective part of physiotherapy for managing muscle strength in stroke patients. Nurses have provided and taught rubber ball grasping therapy. The expected outcome is that patients will comply with performing rubber ball grasping therapy, which will result in increased muscle strength. This is supported by research from Christaputri and Anam (2023), which indicates that patient compliance in performing rubber ball grasping therapy leads to increased muscle strength and improved quality of life.

Conclusion

Based on the results of research and discussion regarding the application of rubber ball grasping therapy for four days to increase muscle strength in Mr. S, who was diagnosed with non-haemorrhagic Stroke at Tidar Hospital, Magelang City, it can be concluded that Mr. S's muscle strength before the therapy showed a score of 1. This score indicates that there was visible or palpable movement or only slight contraction. After being given rubber ball grasping therapy, Mr. S's muscle strength improved to a score of 2, characterized by fingers and wrists that could be moved slowly but could not fight gravity. Based on the research and data analysis, it can be concluded that there was an increase in muscle strength after four consecutive days of rubber ball grasping therapy, with two training sessions of 15 minutes each day. It is recommended that hospital institutions implement rubber ball grasping therapy as a non-pharmacological approach to increase muscle strength in non-haemorrhagic stroke patients.

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