

Section: General Nursing

Active range of motion combined with rubber ball grip therapy to improve mobility impairment in patient with stroke

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Abstract

Stroke is a condition that occurs when blood supply to the brain is disrupted due to blockage or rupture of brain blood vessels, resulting in brain tissue death which causes paralysis accompanied by symptoms such as hemiparesis, difficulty walking, loss of balance, and decreased muscle strength. This study aims to identify the use of active Range of Motion (ROM) exercise with rubber ball grip training and to determine the outcome of ROM rubber ball exercise implementation on muscle strength in stroke patients with upper extremity paralysis. This research used a descriptive method with a case study approach on one stroke patient who received active ROM exercise in the form of rubber ball grip training. The case study found that the patient's consciousness was *compos mentis*, blood pressure 157/93 mmHg, pulse 107 times/minute, and decreased muscle strength in the right upper extremity. The nursing diagnosis was physical mobility impairment. Nursing interventions consisted of active ROM exercise in the form of rubber ball grip training twice daily for 5 days aimed to increase muscle strength in the upper extremity. After 5 days of intervention, muscle strength in the patient's hand increased, and the patient was able to move the hand. Muscle strength in the right upper extremity improved from scale 3 to scale 4. In conclusion, after undergoing active ROM training with rubber ball grip exercise, the stroke patient experienced an increase in muscle strength in the extremity and this therapy can be considered an alternative non-pharmacological therapy option for stroke patients with physical mobility impairment.

Keywords: Active range of motion, mobility impairment, nursing care, rubber ball exercise, stroke

Introduction

A stroke is a critical condition characterized by paralysis or brain tissue death resulting from disrupted blood flow to the brain (Murphy & Werring, 2020; Hassan & Rohatgi, 2009). This acute loss of brain function can be life-threatening and occurs when the blood vessels supplying oxygen and nutrients either become blocked or rupture. This oxygen deficiency leads to significant motor control dysfunction (Terson de Paleville et al., 2011; Baxter et al., 2008). Common triggers for stroke include underlying conditions such as hypertension, diabetes mellitus, and heart disease, as well as lifestyle factors like smoking, stress, obesity, and high cholesterol. These factors contribute to fat deposits in the blood vessels, leading to infarction (tissue death) or ischemia (inadequate oxygen supply). These conditions often result in arteriosclerosis, a process where blood vessels harden and narrow. In cerebral vessels, this narrowing can lead to blood clots, causing a non-haemorrhagic stroke; simultaneously, these hardened vessels become fragile and increasingly prone to rupture. Beyond the immediate neurological impact, stroke patients often face complications such as heart problems, pneumonia, venous thromboembolism, fever, post-stroke pain, dysphagia, incontinence, and depression. A primary consequence of stroke is a significant decrease in muscle strength caused by hemiparesis (weakness on one side of the body) and the subsequent immobilization of the sufferer.

Therefore, stroke patients require therapy focusing on active or passive repetitive movements. One such therapy is Range of Motion (ROM) exercises consisting of gripping or clenching the hand tightly as applied in rubber ball grip training. This stimulates increased neuromuscular and muscular biochemical activity. It stimulates nerve fibers in the extremity muscles, especially parasympathetic nerves to produce acetylcholine, which causes muscle contractions. Rubber ball grip exercise aims to stimulate motor function in the hand by gripping the ball. Gripping a flexible textured ball stimulates muscle fibers to contract. Therefore, muscle contractions in the hand increase muscle strength caused by motor unit activation through acetylcholine production (a chemical released by motor neurons of the nervous system to activate muscles) (Azizah & Wahyuningsih, 2020). This rubber ball grip therapy has also been proven effective in increasing upper extremity muscle strength in stroke patients. The choice of ROM exercise using rubber ball grip provides nurses with opportunities to participate in providing additional care. Nurses can act as consultants advising clients on appropriate choices or assist in direct care provision. However, further development

through evidence-based research is necessary to establish this as a better nursing practice. The nurse's role in this therapy can be adjusted according to their scope and established SOPs.

Case Description

The patient is Mr. S is a 62-year-old male, suffering from an uncontrolled hypertensive crisis, a medical examination confirmed the diagnosis of stroke. His general condition is sufficient, consciousness is compos mentis, mucous membranes are moist, conjunctiva is pink, sclera is not icteric, skin is elastic, skin turgor is good, chest wall movement is symmetrical, lung auscultation is vesicular, heart sounds are normal, sinus tachycardic, bowel sounds are heard 12x/minute, the patient's extremities feel heavy when moving the right hand and foot, the hands and feet feel weak, and there is weakness in the patient's extremity movements in the right extremity with the muscle strength scale

A 62-year-old patient presented with vital signs: blood pressure 157/93 mmHg, pulse rate 107 times/min, temperature 36.5°C, respiratory rate 26 times/min. Laboratory tests revealed HB: 14.3 g/dl, hematocrit 41%, leukocytes 9.1 thousand/ μ L, erythrocytes 4.89 million/ μ L, and platelets 238 thousand/ μ L. The nursing problem identified was physical mobility impairment related to neuromuscular disturbance and weakness of the limbs, evidenced by complaints of weakness and right hemiparesis. Nursing care plan after 5 x 24 hours of intervention targeted increased physical mobility with outcome criteria of increased muscle strength and improved physical activity. Intervention for the nursing diagnosis of impaired physical activity related to neuromuscular disturbance and limb weakness included an innovative intervention in the form of rubber ball grip therapy. Initial evaluation on June 23, 2025, showed: Subjective: Patient reported weakness in right hand and foot. Objective: Muscle strength scale 3, vital signs: BP 183/100 mmHg, pulse 81 times/min, temperature 36.5°C, respiratory rate 22 times/min, SpO₂ 96%. Final evaluation on June 27, 2025 as follows: Subjective: The patient said the right hand and leg still felt weak but there was an increase in strength. Objective: Muscle strength increased on a scale of 4 TTV: BP: 164/90 mmhg N 60 x/min S 36.2 C RR 20 x/min spo₂ 96%.

Discussion

The nursing problem identified was Physical Mobility Impairment. Nursing interventions were implemented for 5 days according to the planned interventions. The rubber ball grip exercise involves a rubber ball that has small protrusions on its surface that can stimulate specific points on the hand, gradually transmitting signals to the brain. This case study explains that gripping a rubber ball with small protrusions on its surface can stimulate acupressure points on the hand, which in turn stimulates sensory nerves in the hand that send signals to the brain. Gripping the hand moves the muscles, thereby activating brain control over those muscles (Ambike et al., 2014; Shaughnessy et al., 2020). The response is transmitted to the sensory cortex through the nerve cell bodies from spinal levels C7-T1. This triggers nerve responses that perform actions based on these stimuli (Margiyati et al., 2022). The rubber ball grip exercise is performed on the palm of the hand, where a flexible and ridged-textured ball is placed, followed by flexion and extension exercises. Before starting the actual exercise, a warm-up is done with Range of Motion (ROM) shoulder exercises first (Azizah & Wahyuningsih, 2020).

The implementation of this case study is consistent with the case study research by Azizah & Wahyuningsih (2020), involving physical therapy exercises: application of rubber ball grip therapy by adjusting position, performing warm-up grip movements such as moving the elbow toward the upper arm (flexion) and extending the upper arm again (extension); finger movements include gripping (flexion), opening the grip (extension), spreading the fingers apart (abduction), bringing them back together (adduction), bringing the thumb to the palm (opposition). The rubber ball is placed on the palm, and the patient is instructed to grip or squeeze the rubber ball firmly for 5 seconds and then release the grip. This is repeated for a duration of 5-15 minutes. Finally, the patient is returned to the starting position and informed that the exercise session has ended (Azizah & Wahyuningsih, 2020). The final evaluation after five days of intervention on the case study subject showed an increase in muscle strength after performing rubber ball gripping exercises twice daily for 5 consecutive days, with right hand muscle strength improving from scale 3 to 4. This is supported by research from Rahmawati et al. (2021), which showed that rubber ball grip therapy also effectively increases upper extremity muscle strength in stroke patients.

In this case study, nurses play a critical role as primary facilitators of the rehabilitation process (Lorenz et al., 2024; Shirozhan et al., 2022), by designing and implementing a structured intervention plan that combines active range of motion (ROM) with rubber ball grip therapy. The nursing process begins with a comprehensive physical assessment where nurses use tools like Manual Muscle Testing (MMT) or handgrip dynamometers to establish the patient's baseline muscle strength. Once a diagnosis of impaired physical mobility is confirmed, nurses take on the responsibility of positioning the patient correctly to ensure exercises are performed safely and effectively. During the active sessions, the nurse provides clear instructions and verbal cues to guide the patient through repetitive gripping motions, which are essential for stimulating neuromuscular responses. Beyond direct physical assistance, nurses are responsible for monitoring the patient's physiological response (Schondelmeyer et al., 2019; van Zeist-de Jonge et al., 2025) and ensuring that the intensity of the serrated rubber ball exercises does not cause pain or overexertion. They act as educators by training both the patient and their family on the importance of movement, thereby fostering adherence to the therapy outside of supervised sessions. Nurses also meticulously document each session, tracking

improvements in fine motor control and the patient's ability to perform daily activities like holding a spoon independently. Their consistent presence over several days—often involving twice-daily sessions—provides the necessary emotional and professional support to motivate the patient toward motor recovery. By integrating these simple but effective non-pharmacological tools into routine nursing care, they help bridge the gap between clinical stabilization and functional independence. Ultimately, the nurse's role is that of a rehabilitation coordinator who ensures the therapy is applied gradually and continuously to achieve meaningful gains in upper extremity mobility

Conclusion

Based on the findings of this case study, the evaluation of muscle strength improvement following the systematic implementation of rubber ball gripping exercises demonstrates that this intervention is a highly effective non-pharmacological therapy. The data indicates that the primary driver of success is the consistency and repetition of the movement, which creates a steady demand on the musculoskeletal system to enhance grip strength and forearm stability. Recovery of muscle strength, particularly within the upper extremities, is a complex process that relies on the dual stimulation of muscle contractions and the activation of sensory nerves on the surface of the hand. By engaging these neurological and physiological pathways, the exercise prevents atrophy and encourages the re-establishment of motor coordination. Furthermore, this study highlights that rehabilitation is not an instantaneous process but one that requires a gradual and continuous timeline to be truly impactful.

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