

Effectiveness of Textured Rubber Ball Grip Therapy on Muscle Strength in Stroke Patients

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ABSTRACT

Stroke is one of the leading causes of disability worldwide and often results in decreased muscle function, particularly in the upper extremities. Muscle weakness can hinder stroke survivors from performing daily activities independently. One simple and affordable rehabilitative approach is the use of textured rubber ball grip therapy, which is believed to enhance muscle strength in post-stroke patients. This study aimed to determine the effectiveness of textured rubber ball grip therapy in improving muscle strength among stroke patients in the Darek Public Health Center work area. This study used a pre-experimental design with a one-group pre-test and post-test approach. A total of 33 stroke patients meeting the inclusion criteria were selected through total sampling. The intervention involved gripping exercises with a textured rubber ball for 10–15 minutes, twice daily for one month. Muscle strength was assessed before and after the intervention using the Manual Muscle Testing (MMT) method. Data analysis was performed using the Wilcoxon test. There was a significant improvement in muscle strength after the therapy ($p < 0.025$), indicating the effectiveness of textured rubber ball grip therapy in enhancing muscle strength among stroke patients. This method can serve as a non-pharmacological intervention option for stroke rehabilitation, particularly in primary healthcare settings.

Keywords: Stroke, Muscle strength, Rubber ball, Grip therapy

INTRODUCTION

Stroke, also known as a cerebrovascular accident (CVA), is a condition in which brain function is impaired due to an obstruction of blood flow to the brain. One form of stroke is non-hemorrhagic stroke, which occurs as a result of ischemia, blood clot formation (thrombus), embolism, or narrowing of the blood vessels. This type of stroke is classified as a non-communicable disease, with an incidence rate that continues to increase. In general, stroke is classified into two main types: ischemic stroke (non-hemorrhagic) and hemorrhagic stroke. Ischemic stroke occurs due to blockage of the blood vessels in the brain, which then disrupts the function of the central nervous system and has the potential to cause hemiparesis¹.

At the global level, stroke or cerebrovascular accident ranks as the second leading cause of death and the third leading cause of disability. Approximately 70% of stroke-related deaths and 87% of total disability cases associated with stroke occur in developing countries. Over the past four decades, the incidence of stroke in these countries has more than doubled². In Indonesia, the prevalence of stroke is 10.9 per mille based on medical diagnoses. According to the 2018 Basic Health Research (Riskesdas), the number of stroke cases in West Nusa Tenggara Province (NTB) increased from 4.5% in 2013 to 8% in 2018³.

One form of intervention in the rehabilitation process of stroke patients includes the administration of medications such as heparin, warfarin (coumadin), aspirin, or clopidogrel (Plavix), as well as other medical therapies. In addition, physical exercises such as aerobics, coordination training, and muscle strengthening also play an important role in supporting recovery. One alternative therapeutic method that can be used is gripping exercises with a rubber ball that is round, flexible, textured, and can be squeezed with light force⁴.

Therapy by gripping a textured rubber ball has the potential to increase hand muscle strength. This activity aims to improve hand motor function⁵. This method is effective in stimulating muscle contraction and strengthening muscle tissue. The advantage of this therapy lies in the easy accessibility of the tool used, as the rubber ball is easy to find and can be utilized in various settings⁶.

The initial survey conducted in the Darek Public Health Center work area showed that there were 40 stroke patients, 7 of whom had died. Textured rubber ball grip therapy was still very rarely applied to stroke patients in the area. This was due to a lack of knowledge both from patients and their families, so this therapeutic exercise was never carried out at home. This situation became the background for the researcher's interest in applying textured rubber ball grip therapy to improve muscle strength in stroke patients in the Darek Public Health Center work area.

METHODS

Research design

This study was a quantitative research with a pre-experimental approach, using a one-group pre-test and post-test design. According to Nursalam⁷, this design aims to determine the effectiveness of an intervention by involving a single group of subjects.

Population and sample

The population used in this study consisted of stroke patients within the last five years, totaling 40 individuals. Sampling in this study was determined based on inclusion criteria using a total sampling technique. The study was conducted in the Darek Public Health Center work area with a total of 33 stroke patients.

Research instrument

The instruments used in this study were the SOP (standard operating procedure) for textured rubber ball grip therapy and a muscle strength assessment. The SOP consisted of three stages: preparation, implementation, and termination. Meanwhile, muscle strength was assessed on a scale of 0–5. A score of 0 means no palpable contraction; a score of 1 means no visible movement but palpable muscle contraction; a score of 2 means full ROM but unable to resist gravity; a score of 3 means full ROM and able to resist gravity; a score of 4 means full ROM, able to resist gravity with minimal resistance; and a score of 5 means full ROM, able to resist gravity with maximal resistance.

Data collection

The research activities aimed to analyze the muscle strength of stroke patients before and after the intervention of textured rubber ball grip therapy in the Darek Public Health Center work area. The study was conducted over one month with four meetings. In the first meeting, before the activity, respondents signed the informed consent form. In the second meeting, muscle strength was assessed before the intervention, after which the textured rubber ball grip therapy was immediately provided. The third meeting was conducted to monitor the exercise, and in the fourth meeting, muscle strength was measured after the intervention.

RESULTS

The results of the study are presented in narrative and tabular form, comprising univariate and bivariate analysis with significant p-values from the Wilcoxon test.

Table 1. Characteristics of Respondents Based on Age

Age	Frequency (n)	Percentage (%)
36–45	9	27.3
46–55	14	42.4
56–65	10	30.3
Total	33	100

Table 1 shows that the largest group of respondents were aged 46–55 years, totaling 14 people (42.4%), while the smallest group were aged 36–45 years, totaling 9 people (27.3%).

Table 2. Characteristics of Respondents Based on Gender

Gender	Frequency (n)	Percentage (%)
Male	21	63.6

Female	12	36.4
Total	33	100

Table 2 shows that most of the respondents were male, totaling 21 people (63.6%).

Table 3. Frequency Distribution of Muscle Strength in Post-Stroke Patients Before the Intervention of Textured Rubber Ball Grip Therapy

Muscle Strength Scale	Dexter (n)	Sinistra (n)	Percentage (%)
0	0	0	0
1	0	0	0
2	9	2	33.3
3	10	4	42.4
4	8	0	24.3
5	0	0	0
Total	27	6	100

Table 3 shows that before the intervention, 11 respondents (33.3%) had a muscle strength scale of 2 (9 dexter, 2 sinistra), 14 respondents (42.4%) had a scale of 3 (10 dexter, 4 sinistra), and 8 respondents (24.3%) had a scale of 4 (8 dexter, 0 sinistra).

Table 4. Frequency Distribution of Muscle Strength in Post-Stroke Patients After the Intervention of Textured Rubber Ball Grip Therapy

Muscle Strength Scale	Dexter (n)	Sinistra (n)	Percentage (%)
0	0	0	0
1	0	0	0
2	8	1	27.3
3	10	3	39.4
4	9	2	33.3
5	0	0	0
Total	27	6	100

Table 4 shows that after the intervention, 9 respondents (27.3%) had a muscle strength scale of 2 (8 dexter, 1 sinistra), 13 respondents (39.4%) had a scale of 3 (10 dexter, 3 sinistra), and 11 respondents (33.3%) had a scale of 4 (9 dexter, 2 sinistra).

Table 5. Distribution of Muscle Strength in Post-Stroke Patients Before and After the Intervention of Textured Rubber Ball Grip Therapy

Muscle Strength Scale	Pre-Test (%)	Post-Test (%)	<i>p-value</i>
0	0	0	0.025
1	0	0	
2	33.3	27.3	
3	42.4	39.4	
4	24.3	33.3	
5	0	0	
Total	100	100	

Table 5 shows a statistically significant difference in the muscle strength of stroke patients before and after one month of textured rubber ball grip therapy ($p = 0.025$). Before the intervention, the majority of respondents were in the muscle strength scale of 3 (42.4%), which shifted toward scale 4 (33.3%) after the intervention, indicating an overall improvement in muscle strength.

DISCUSSION

The muscle strength of stroke patients who participated as respondents in this study showed weakness in the extremities before receiving the textured rubber ball grip intervention. This study is in line with Maisyaroh et al.⁸, who also revealed that disturbances in voluntary movement control can lead to hemiparesis, which affects physical mobility in the form of motor dysfunction. When neuronal function in the central nervous system declines, it may cause slowed movements, difficulty in thinking and speaking, tremors, and muscle stiffness. If not treated promptly, this condition risks leading to permanent disability.

Based on the results of the textured rubber ball grip therapy intervention conducted in the Darek Public Health Center work area, it was found that the muscle strength scores of stroke patients increased after the intervention.

This is consistent with the study by Margiyati et al.¹ entitled "*The Application of Rubber Ball Grip Exercise on Muscle Strength in Non-Hemorrhagic Stroke Patients*." The findings were reinforced by the statement that providing rubber ball grip exercises for four days in stroke patients was able to improve muscle strength. The activity of gripping and squeezing a textured ball can stimulate weakened nerves, thereby inducing muscle contraction and gradually increasing strength.

Finger motor skills play a vital role in supporting various daily activities. Rubber ball grip exercises involving flexion, extension, abduction, adduction, and opposition movements have been proven effective in strengthening hand muscles in post-stroke patients⁹.

Muscle contractions that occur during the exercise make the hand muscles stronger due to increased activation of motor units triggered by the release of the neurotransmitter acetylcholine¹⁰. This rubber ball gripping exercise is classified as an active-assisted exercise, which involves partially assisted active movements and serves to accelerate the recovery of upper extremity function¹¹.

It should be noted that the effectiveness of this therapy cannot be achieved in a single session but requires a continuous process. This is due to the need for adequate training standards, both in terms of frequency and quality of implementation¹². The success of this therapy program is also strongly influenced by support from the immediate environment. The more actively families are involved in the recovery process of stroke patients, the greater the potential improvement in muscle strength that can be achieved¹.

CONCLUSION

Based on the results and discussion, it can be concluded that gripping a textured rubber ball is effective in improving muscle strength in stroke patients in the Darek Public Health Center work area. This indicates that the more routinely patients practice gripping a textured rubber ball, the greater the improvement in muscle strength; conversely, irregular practice results in no improvement in muscle strength. This study highlights that textured rubber ball gripping can serve as an alternative approach to improving muscle strength in stroke patients. However, the researchers acknowledge several limitations of this study, including the small sample size, short intervention period, and the absence of a control group for comparison.

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