THE EFFECT OF THE BALL GRASPING THERAPY ON THE STRENGTH OF UPPER LIMB MUSCLES IN POST-STROKE PATIENTS FROM STELLA MARIS HOSPITAL IN MAKASSAR

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ABSTRACT

Muscle weakness and physical disability are the main problems that occur in post-stroke patients so that patients will become dependent on others. Muscle strength training is needed so that patients can gradually use their extremities to hold or lift heavier weights to increase independence in carrying out daily activities. The purpose of this study was to increase the strength of upper limb muscles in post-stroke patients through the ball grasping exercise. The design of this study was pre-experimental design with one group pre-post test. The group consists of 14 male and female post non-hemorrhagic stroke respondents who experienced weakness of the upper extremity, aged between 44-75 years. The grasping ball exercise was done every day in the morning and evening with duration of 30 seconds for four weeks. The muscles strength was measured using handgrip dynamometer before and after the intervention. The data were analyzed using paired sample t-test with a significance level of α= 0.05. The average muscle strength before intervention was 0.936 and the average value of muscle strength after intervention was 2,271 (p =0,024). This data showed that there's an effect of the ball grasping therapy on the strength of the upper limb muscles in post-stroke patients. Based on the results, it is recommended that health workers to use the ball grasping exercise as an intervention to increase the arm strength.

Keywords: Ball; Grasping; Muscle; Strength; Stroke

INTRODUCTION

Stroke was the second leading cause of global death after ischemic heart disease in 2015. It accounted for 6.7 million (11.9%) global deaths in 2012. Of the 56.9 million deaths worldwide in 2016, more than half (54%) were due to the top 10 causes. Ischemic heart disease and stroke are the world's biggest killers, accounting for a combined 15.2 million deaths in 2016 (Benjamin, et al., 2018) and has been the leading cause of death in nearly all hospitals in Indonesia, 14.5 % (Badan Penelitian dan Pengembangan Kesehatan, 2013).

However, the death toll attributable to stroke remains high and it is estimated that it will increase to 7.8 million deaths worldwide by 2030 (Benjamin EJ, 2017). Based on the data of Basic Health Research (Kemenkes) in 2018, it was found that the highest prevalence of stroke in Indonesia that was diagnosed by health personnel and symptom was in Kalimantan Timur (14,7%), followed by DI Yogyakarta. Overall, the number has increased 7.0 per 1000 population in 2013 to 10,9 per1000 inhabitants by 2018.

Stroke becomes a major problem of movement disorders and body function in adults (Powers WJ, 2018). Motor impairment, typically affecting movement of the face, arm and leg of one side of the body, affects about 80% of stroke survivors (Langhorne, et al., 2009). Upper limb (i.e. arm, hand and/or finger) motor impairments are often persistent and disabling (Lai 2002); only half of all stroke survivors with an initial plegic (paralysed) upper limb regain some useful upper limb function after six months (Kwakkel, et al., 2003), and, of those with initial arm impairment, 50% have problems with arm function four years post stroke (Broeks, et al., 2009). Activities of daily living (ADLs) largely depend on arm function (Sveen, et al., 2004), particularly for personal activities such as feeding, dressing and grooming. One year after stroke, arm motor impairment is associated with anxiety (Morris, et al., 2013) and poorer perception of health-related quality of life (Franceschini, et al., 2010). Therefore, improving upper limb function is a core element of re- habilitation after stroke to maximize recovery (Langhorne & Legg, 2003). Therapists have developed many diverse techniques that aim to rehabilitate arm function after stroke.

Professionals responsible for administering upper limb rehabilitation interventions most often consist of physical therapists and occupational therapists. However, other health professionals (e.g. nurses, doctors) and non-health professionals (e.g. sports professionals, guardians, family members) can also contribute to the provision of interventions (Coupar, et al., 2012; Harris & Eng, 2010).

Therapy is usually given to patients during the hospitalization period, as long as the initial discharge is supported at home or in an outpatient setting.

Recovery of upper limb muscle strength and restoration of joint flexibility requires rehabilitation as soon as possible after the patient's condition is considered stable (Adam, et al., 2014). Rehabilitation that can be given to patients is exercise range of motion or Range of Motion (ROM). Training rationing is preferred to specific skills that are meaningful to patients with stroke (Smeltzer & Bare, 2015), such as; grasping, holding, and lifting objects (Mehrholz & Pohl, 2012). State that one form of specific exercise that can increase muscle strength of the upper extremity and can restore hand function is to use a spring grip device by holding it. To improve the ability to carry out daily living activities and prevent physical disability, physical recovery exercises (functional hands) are needed, namely ball grasping exercises that can be done as early as possible to increase the strength of muscles and joints according to patient needs (Vinstrup, 2018). This exercise is needed especially in areas with limited rehabilitation facilities or health workers.

Based on the results of preliminary studies that were conducted in some hospital in Makassar city, physical exercise rehabilitation has been done by the therapist once a day and sometimes three times per week in the morning, but not optimal due to limitation of personnel therapist and facilities. Nurse who is in charge in the area of stroke has a major role to train the patient due to 24 hours near the patient and when the patient returns to home. The families and patients find it difficult to get access to rehabilitation. Based on the above problem, researcher was interested in knowing the effect of ball grasping therapy to the upper extremity muscle strength in stroke ischemic patients in Stella Maris Makassar, so that this exercise can be carried out by the patient himself at home so that the patient is quickly independent in doing activities daily living.

MATERIAL AND METHOD

This research is an experimental research with quasy experiment design approach with pre-test and post-test equivalent one group design. Sampling method in this research is non-probability sampling with consecutive sampling approach. Sample selection is by specifying subject that fulfill the criteria until certain period of time (Nursalam, 2017). The sample in this study was stroke patients in Stella Maris Makassar, with a total of 14 patients consists male and female The selection criteria for subjects: were hemiplegic patients with non haemorrargic stroke , moderate severity according to the Fugl-Meyer upper extremity test, and able communication . This study was conducted from January 30, to April 2, 2019. aged between 44-75 years eligible for intervention. The grasping ball exercise was done every day in the morning and evening with duration of 20 - 30 seconds for four weeks. this exercise involved the following: Lateral Prehension Grip, Hook Grip, Spherical Grip and Cylindrical Grip, hold tight for 5 minutes then relax. Repeat 7 times.

RESULT

The strength of the upper limb muscle before being given ball grasping therapy (pre intervention) obtained an average was 0.936 with a standard deviation of 1.6 and after being given ball grasping therapy (post intervention) obtained the mean variable was 2.721 with a standard deviation of 3.9. (table 2) it is found that the value of t count (2.548) > t (table 3) and the value of ρ (0.024) <α (0.05) see (table 3) It can be concluded that there is the effect of ball-grasping therapy on muscle strength of the upper limb in post-stroke patients.

Table 1.
Frequency Distribution Based On Age, Sex, And Type Of Stroke Respondent

Characteristics of Respondents	f	%
Age		
35 – 44	1	7,1
45 – 54	3	21,4
55 – 64	3	21,4
65 – 74	3	21,4
>75	4	28,6
Gender		
Male	5	35,7
Female	9	64,3
Type of Stroke		
NHS	13	92,9
HS	1	7,1

Table 2.
Analysis of Pre And Post Muscle Strength

Group	N	Mean ±SD	Min - Max
Muscle Strength Pre Intervention	14	0,936 ±1,6	0,0 - 5,5
Muscle Strength Post Intervention	14	2,721 ±3,9	0,0 - 10,0

Table 3.
Analysis of The Effect of Ball Grasping Therapy On Muscle Strength of The Upper Extremity

Group	n	Mean ±SD	Min-Max	t	p
Muscle Strength Pre Intervention	14	0,936 ±1,6	0,0-5,5	2,548	0,024
Muscle Strength Post Intervention	14	2,721 ±3,9	0,0-10,0		

DISCUSSION

A stroke causes damage to the sensory motor cortex, subcortical areas and/or cerebellum can result in the following 1. Loss of motor control, which causes difficulties with, or prevents, the voluntary production of movement, and compromises dexterity and co-ordination of the fingers, hands and arms (Gillen & Nilsen, 2016). These impairments make many ADLs difficult, especially those activities that depend on coordination between both upper limbs or fine finger movements. With time, the tendency is to use the unaffected limb predominantly and to disregard the affected limb, thereby developing learned non-use (Taub, et al., 2006) .

In this study, the results of the evaluation found that the strength of the fore arm muscles increased when compared to muscle strength before ball training. The average muscle strength before intervention was 0.936 and the average value of muscle strength after intervention was 2,271 (p =0,024).

In accordance with the theory of ball grasping therapy is the exercise of increasing the workload of muscle tissue so that the muscles enlarge which can affect muscle strength (Daya, 2017) and large muscle fibbers will affect muscle contraction so that the arm can move because the movement of electrical impulses that cause the release of potassium ions raises attractive forces between actin filaments and myosin, which causes both filaments to move together, and produce contractions (Bott, 2014)

Ball grasping therapy is useful for stimulating nerve connectivity. The spinal nerve involved in the process of grasping the ball is the cervical nerve 7 to the thoracic nerve 1 (C7-T1), the radial nerve to the arm's extremes, the median nerve which supplies the flexor (grasping) muscles of the forearm, the thumb muscles, and gives sensation in the hand, and the ulnar nerve which innervates the small muscles of the hand, the skin of the little fingers on both sides of the half medial ring finger (Squire, et al., 2012)

According Lee, et al. (2012), muscle strength training has been shown to be effective in improving upper limb function in sub-acute stroke from the results of intervention for 4 weeks (about 7 weeks post stroke), the intervention group showed an increase greater upper limb function compared to the control group (mean difference 6.2; 95% CI: 3.4 to 9.0; P <0.001).

Whereas Vinstrup, et al (2017) found, these results indicate that finger flexion exercise should be the preferred strengthening exercise to achieve high levels of muscle activity in the flexor and extensor arm muscles in chronic stroke patients and Repetitive hand and finger exercises have the potential to improve upper limb function in stroke patients regardless of recovery stage. Physical training has been shown to improve functional deficits following stroke. In stroke patients, grip strength is associated with higher levels of independence during ADL (Bae, et al., 2015) and correlates moderate to highly with function and performance tests of the upper limb (Bertrand, et al., 2015). Although no consensus on which outcome measures to choose when evaluating upper limb function following stroke exists (Lang, et al., 2013; Murphy, et al., 2015), the importance of focusing on early activation and frequent movement repetition for motor rehabilitation of the paretic hand has therefore been stressed in the stroke literature (Kahn, 2006). The

repetition of functional relevant movements, including all types of hand and finger actions, of the paretic side may thereby decrease the negative effects of depression in perilesional brain areas via discontinuation of the disuse that normally follows stroke (Furlan, et al., 2016). In addition, regaining muscle strength of the paretic arm and hand should be emphasized as this may improve the odds of meeting the inclusion criteria for certain interventions. For example, one of the most studied and successful forms of upper limb rehabilitation in chronic stroke patients, constraint-induced movement (Barzel, et al., 2015) often has strict mobility and strength requirements for participation (Kwakkel, 2015). Therefore, effective hand exercises to improve the grip strength and hand function in chronic stroke patients are warranted, as these will function as a necessary precursor for the successful addition of more functional rehabilitation practices.

CONCLUSION

Effective upper limb interventions that can be delivered across the stroke pathway-in hospitals and rehabilitation, outpatient and home settings-are clearly needed. In addition to interventions that can be delivered by healthcare professionals, self-management strategies must be available to promote more independent recovery among stroke survivors.

SUGGESTION

It is expected that health workers, families and patients should use ball grasping therapy as an adjunct therapy to accelerate the increase in upper extremities muscle strength in patients with ischemic stroke when at home or in areas where rehabilitation facilities are not available. The limitation of this study is that the number of subjects is small and only use one group; there was no number of control group. In the future, use a larger subject and use group controls.

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