



The Effect Of Combination *Spherical Grip* And *Kinesio Taping* Exercise To Enhance Of Muscle Strength In Ischemic Stroke Patients In Jemursari Islamic Hospital Surabaya

Qori Maryanto¹, Handayani², Wesiana Herisanti³

¹Nahdlatul Ulama University Surabaya
Jl. SMEA. Nomor 57, Kota Surabaya, East Java 60243, Indonesia

²Nahdlatul Ulama University Surabaya
Jl. Mulyorejo, Kota Surabaya, East Java 60115, Indonesia

³Nahdlatul Ulama University Surabaya
Jl. SMEA. Nomor 57, Kota Surabaya, East Java 60243, Indonesia
Email:1110016015@student.unusa.ac.id

Abstrak

Pasien stroke iskemik adalah masalah utama yang terjadi ketika gangguan aliran darah otak. Data Global Burden Disease menunjukkan bahwa semua populasi memperoleh 80% stroke iskemik dan 20% stroke hemoragik dengan hambatan mobilitas fisik yaitu kelemahan otot yang diperoleh 58%. Tindakan keperawatan yang bisa dilakukan, salah satunya adalah dengan memberikan aktivitas pada pasien stroke yang bermanfaat untuk meningkatkan aliran darah otak. Penelitian ini bertujuan untuk menganalisis pengaruh kombinasi latihan cengkeram sferis dan plester Kinesio terhadap kekuatan otot pasien stroke iskemik di Rumah Sakit Islamemursari Surabaya.

Desain penelitian ini adalah Kuasi Eksperimen dengan pendekatan desain kelompok kontrol pre post test. Semua populasi adalah pasien stroke iskemik di ruang azzahra 1 sebanyak 41 orang, sampel 38 responden dibagi menjadi 19 kelompok perlakuan dan kontrol. Pada kelompok intervensi diberikan kombinasi Spherical Grip dan Latihan merekam Kinesio selama 20 menit dua kali sehari selama 3 minggu. Sedangkan pada kelompok kontrol diberikan pelatihan sesuai dengan prosedur Rumah Sakit. Analisis statistik yang digunakan Wilcoxon menandatangani uji peringkat dan uji Mann-Whitneya <0,05.

Hasil penelitian ini menunjukkan bahwa peningkatan rata-rata penyempitan otot pada kelompok intervensi 2,83, dan kelompok kontrol besar adalah 1,10. Analisis denganMann Whitney showed p = 0,000. Sehingga H0 menolak ini berarti ada efek kombinasi latihan Spherical Grip dan Kinesio taping pada peningkatan kekuatan otot pada pasien stroke iskemik di rumah sakit Islam Jemursari.

Kombinasi dari Spherical Grip dan Kinesio taping yang dilakukan secara rutin dapat meningkatkan kekuatan otot, menghasilkan peningkatan kekuatan otot pada pasien stroke iskemik. Perawat perlu menerapkan Spherical Grips dan Kinesio taping pada pasien stroke iskemik pada fase rehabilitasi.

Kata kunci : *Stroke iskemik, Spherical Grip dan Kinesio taping, Kekuatan Otot.*

Abstract

Ischemic stroke patients are the main problem that occurs when disruption of cerebral blood flow. Data Global Burden Disease shows that all populations obtained 80% ischemic stroke and 20% hemorrhagic stroke with physical mobility barriers namely muscle weakness obtained 58%. Nursing actions that can be done, one of which is by giving activity to stroke patients who are useful to increase cerebral blood flow. This study aiming to analyze the effect of combination of spherical grip exercise and Kinesio taping to the muscle strength of ischemic stroke patients in Jemursari Islamic Hospital Surabaya.

This design of the study is Quasi Experiment with approach pre post test control group design. All populations are ischemic stroke patients in the azzahra room 1 as many as 41 people, a sample of 38 respondents divided into 19 treatment and control groups. In the intervention group was given a combination of Spherical Grip and Kinesio taping Exercise for 20 minutes twice a day for 3 weeks. Whereas in the control group was given training accordance with Hospital procedures. Statistical analysis used Wilcoxon signed rank test and Mann-Whitney test < 0,05.

The results of this research show that the mean increase in muscle constriction in the intervention group 2.83, and a big control group is 1.10. Analysis with Mann Whitney showed $p = 0.000$. So that H_0 rejected this means that there is an effect of a combination of Spherical Grip and Kinesio taping exercises on increasing muscle strength in ischemic stroke patients in Jemursari Islamic hospitals.

The combination of Spherical Grip and Kinesio taping routinely performed can increase muscle strength, resulting in increased muscle strength in ischemic stroke patients. Nurses need to apply Spherical Grips and Kinesio taping to ischemic stroke patients in the rehabilitation phase.

Keyword : Ischemic stroke, Spherical Grip and Kinesio taping, Muscle Strength.

Article info:

Article submitted on January 05, 2018

Articles revised on February 07, 2018

Articles received on March 07, 2018

DOI: [http://dx.doi.org/10.21927/jnki.2018.6\(2\).113-123](http://dx.doi.org/10.21927/jnki.2018.6(2).113-123)

INTRODUCTION

Stroke is an occurrence of problems that occurred in society in this era, stroke is becoming an increasingly serious problem to be addressed in the whole world. This is because the incidence of a very sudden stroke can lead to a death in a person, physical and mental disability both in the productive age and the elderly (1). Ischemic stroke is caused by thrombus or embolism in blood flow to the brain and whereas hemorrhagic stroke is caused by bleeding in the brain tissue or in the subarachnoid space (2). Stroke is also a deficit (disturbance) function of the nervous system that occurred suddenly, caused by circulatory disorders in the brain (3).

The problem caused by stroke for human life is very complex. Disorders of vital brain functions such as coordination disorders, balance disorders, posture control disorders, sensation disturbances, and motion reflex disorders will reduce the ability of individual functional activities every day. Stroke patients

will experience paralysis for a while so that there is muscle weakness in the patient because this will give a disruption to the head nerves which will make the vein to drain blood to all parts of the muscle not well flowed (4).

Muscle strength is the ability of the muscle to withstand the burden of both external and internal loads. Muscle strength is closely related to the neuromuscular system, namely how much the ability of the nervous system to activate the muscles to contract so that the more muscle fibers are activated, the greater the strength produced by these muscles, so that ischemic stroke patients use a combination of spherical grip and *kinesio taping* is not done yet to help increase muscle strength (4).

According to WHO (*World Health Organization*) 2013, stroke deaths in the United States are 795,000 people. At 610,000 people who got the first stroke and 185,000 people were recurrent stroke. Four million people in the United States live post stroke, 15-30% experience

permanent disability (5). The prevalence of stroke patients in Indonesia in 2013 was 7 out of 1000 people had a stroke and every 7 of the people who died, 1 of them had a stroke (6). Data from Global Burden Disease in 2010, showed that of the total population there were 80% who experienced ischemic stroke while those with hemorrhagic 20%.

Based on the results of the Basic Health Research survey (6), the prevalence of stroke in Indonesia increases with age. For the highest cases of stroke diagnosed health workers are aged 75 years and over (43,1%) and the lowest in the 15-24 year age group is (0.2%). The prevalence of stroke based on sex was more men (7.1%) compared to women (6.8%). Based on residence, the prevalence of stroke in urban areas is higher (8.2%) and compared to rural areas (5.7%). According to data from Basic Health research (7) the number of patients diagnosed with stroke by health workers or with symptoms of stroke in the East Java was 16.0% where East Java occupied the fourth highest area in Indonesia. Data of 2013 stroke disease recapitulation from the Surabaya Health Office found the total number of stroke patients in 2013 were 1166 people with the same number of men and women, namely 583 people. This is in accordance with the incidence rate obtained in patients who had a stroke in Az-Zahra room1 Jemursari Islamic Hospital Surabaya in the period of September 2016-2017 which amounted 156 people, consisting of 91 (58.3) who had ischemic stroke and experienced obstacles physical mobility, namely muscle weakness and 65 (41.7%) incidence of hemorrhagic stroke and total number (100%).

In ischemic stroke patients 90% of infarcts often occur in the area of 4-6 brodman which is the motor center which will cause no impulses to be sent to the fingers and no movement so that the muscle strength of the fingers will decrease. As many as 55% of patients who experience an

ischemic stroke experience more weakness in the hand, especially in the fingers (8).

Stroke patients with muscle weakness will experience limited mobilization. Patients who got limitations in mobilization will experience limitations of a few or all to perform a range of motion independently. Physical and mental weakness will prevent someone from doing their daily activities. In general, there are two types of disability: primary disability and secondary disability, primary disability caused by illness or trauma (eg paralysis of disorders or injury to the spinal cord) while primary disability (eg muscle weakness and bed rest) (9). Muscle weakness is a clue to the disruption of the motor system at a point or several places from the control circuit from the motor neuron cell to the muscle fibers (10).

This is supported by the research conducted by (11) about effectiveness *Range Of Motion* active-asistif (*Spherical Grip*) to increase muscle strength extremely done by stroke patients in Tugurejo Regional General Hospital Semarang. The results obtained from the Spherical Stroke ROM with a duration of 5 days and performed twice a day. Research conducted by (12) about *kinesio taping* application and Motor Relearning Program Method (MRP) n improving the road pattern of post-stroke patients showed the results in the group given *kinesio taping* had an average age of 65.1 years with the number of 6 men and 4 women the duration of exercise 3 times a week with 60 minutes for 4 weeks. This shows that of exercise to presence can increase muscle strength in stroke patients.

Nursing action that aimed to be carried out are one of the active motion therapies that can be done by spherical grip. Spherical grip is an exercise to stimulate motion in the hand with the form of grasping function training. This exercise is carried out through three stages, namely opening the hand, closing the fingers to grasp the object and to adjust the grip strength.

This exercise aims to have the functional hand to hold a round object like a ball on the palm of the hand (4). Helping recovery of the arm or part of the upper extremity requires a technique to stimulate the hand like a Spherical grip exercise which is a functional hand by holding a spherical object like a ball on the patient's palm. Spherical grip is a smooth sensory modality and pressure on the receptors of encapsulated end organs in the upper extremities. The response will be conveyed to the sensory cortex in the sensory pathway through the cell body on the C7-T1 nerve directly through the limbic system, in which the existing excitatory processing causes a very rapid response in the nerve to act on the stimulus (13).

Kinesio taping is an application that is able to increase the sensomotor ability of stroke patients. *Kinesio taping* can increase proprioceptive feedback so as to produce the correct body position, this becomes a very basic thing that is needed when exercising to restore the function of the performed limb. stimulation of the neuromuscular system in activating the performance of nerves and muscles when performing a functional motion. *Kinesio taping* will also facilitate mechanoreceptors to direct suitable movements and provide comfort in the Both of these actions are to improve muscle strength in stroke patients, so as to improve the outcome of treatment in stroke patients. Muscle strength is performed using a scale *Manual Muscle Testing* (MMT) 0-5. On this scale it is used as an ingredient to measure motor weakness and see progress over time to weakness in muscle strength (14). Muscle strength is assessed using a score of 0-5 using a scale Manual Muscle Testing (MMT), that is : 0 = Paralyzed: there is not the slightest muscle contraction, 1 = there is little muscle contraction : but there is no movement in the joints that the muscles must move, 2 = obtained movement, but this movement is unable to contra gravity (gravity), 3 = can carry

out movements against gravity (gravity), 4 = besides being able to fight gravity (gravity): it can also overcome a little resistance given, 5 = no paralysis (normal).

Research on the effect of a combination of Spherical grip and *Kinesio taping* exercises on increasing muscle strength in ischemic stroke patients has not been studied yet. Based on the description, the researcher to interested in examining the effect of a combination of Spherical grip and *Kinesio taping* exercises on increasing muscle strength in ischemic stroke patients in Jemursari Islamic hospital Surabaya.

MATERIALS AND METHOD

Design of this uses quasi experiments with pre and post test studies functionated to find a causal relationship between the independent variable and the dependent variable with in a certain time period. In this study the researchers divided into two groups, the treatment group that will be given a combination of Spherical Grip and *Kinesio taping* exercise and a control group that will be given training according to the standards of Jemursari islamic Hospital Surabaya. The results obtained to see the difference in the level of muscle strength in the treatment and control groups. Population in this study is in accordance with the number of respondents who received a combination of spherical grip and *kinesio taping* as many as 41 respondents. The sampling technique in this study was consecutive sampling. The samples in this study were 38 respondents according to the inclusion criteria set by the researcher; the study was conducted in June 2018.

Research data was obtained by using a data collection tool in the form of a scale *Manual Muscle Testing* (MMT), that is : 0 = Paralyzed: there is not the slightest muscle contraction, 1 = there is little muscle contraction: but there is no movement in the joints that the muscles must move, 2 = obtained movement, but this movement is unable to fight gravity (gravity),

3 = can carry out a movement against gravity (gravity), 4 = besides being able to fight gravity (gravity): it can also overcome the few given resistance, 5 = not there is paralysis (normal).

Retrieval of data in this study is by observing muscle strength to the respondent being accompanied by researchers and nurses on duty at the hospital. Data analysis method in this study used an analysis model *Wilcoxon signed rank test* and *Mann-Whitney test* < 0,05.

RESULT AND DISCUSSION

Normality test

Kolmogorov-Smirnov test is carried out on the data description characteristics of research variables to assess the nature of distribution, including normal data distribution or abnormal data distribution. Tests performed on the dependent variable showed a value of $\alpha > 0.05$ so that the distribution of data is normal.

Table 1 Test Normality

Variable	Group	Normality
MMT	Pre Treatment	0,000
	pre control	0,000

Based on table 1, the *Kolmogorov-Smirnov* test was obtained on the data description characteristics of the research variable worth 0.000 where the value > 0.05. This means the data is not normally distributed. Then the researchers analyzed the data using the *Wilcoxon test* and *Mann-Whitney test*.

Based on the results of research that has been carried out on clients of ischemic stroke

in Jemursari Islamic Hospital Surabaya as follows:

Muscle strength before and after a combination of Spherical grip and *Kinesio taping* exercises in ischemic stroke patients in the treatment and control groups.

Based on table 2 before administering a combination of Spherical grip and *Kinesio taping* exercises in the treatment group Mean muscle strength get value 1.53, namely There is a slight muscle contraction, but no movement in the joints that must be moved by muscles is obtained. Whereas the mean muscle strength scores after done a combination of Spherical grip and *Kinesio taping* exercises get value 4.36, namely in addition to be able to fight gravity, it can also overcome a little resistance and the delta result shows a number of 2.83. and in the control group Mean value muscle strength before training based on result standard hospital 1.42, namely there was little muscle contraction, but no movement in the joints that had to be moved by the muscles was obtained. Whereas the mean value of muscle strength after action based on standart hospital 2.52, namely is obtained by movement, but this movement is unable to fight gravity, and the result of mean value delta showed number of 1.10.

Based on statistical tests with *Wilcoxon signed rank test*, it was obtained that $p = 0,000$ in the intervention group, It means that there were differences in muscle strength before and after intervention, a combination of Spherical grip and *Kinesio taping* exercises. In the control group, it

Table 2. Muscle Strength

Variable	Min			Max			Mean		
	Pre	Post	Delta	Pre	Post	Delta	Pre	Post	Delta
Treatment	1,00	4,00	3,00	2,00	5,00	3,00	1,53	4,36	2,83
Control	1,00	2,00	1,00	2,00	5,00	3,00	1,42	2,52	1,10
<i>Wilcoxon</i>			$p = 0,00$			$p = 0,00$			
<i>Mann-Whitney Pre</i>					$p = 0,52$				
<i>Mann-Whitney post</i>					$p = 0,00$				

Source: Primary data 2018.

was obtained $p = 0,000$ which showed that there were differences in muscle strength before and after being given standard therapy in the room in ischemic stroke patients. In the statistical test with Mann-Whitney Pre Test obtained $p = 0.521 > \alpha 0.05$, It means there is no difference in muscle strength between the intervention group and the control group. In the statistical test Mann-Whitney Post Test obtained $p \text{ value} = 0,000 < \alpha 0.05$, It means that H_0 is rejected, which means there is a difference in muscle strength between the intervention group and the control group, so there is an effect of a combination of Spherical grip and *Kinesio taping* exercises on muscle strength of ischemic stroke patients.

Stroke patients with muscle weakness will experience limited mobilization. Patients who experience limitations in mobilization will experience limitations of a few or all to perform a range of motion independently. Physical and mental weakness will prevent someone from doing their daily activities. In general, there are two types of disability: primary disability and secondary disability, primary disability caused by illness or trauma (sample: paralysis of disorders or injury to the spinal cord) while primary disability (sample: muscle weakness and bed rest) (9). Muscle weakness is a clue to the disruption of the motor system at a point or several places from the control circuit from the motor neuron cell to the muscle fibers (5).

Stroke patients will experience paralysis for a while so that there is muscle weakness in the patient because this will give a disruption to the head nerves which will make the vein to drain blood to all parts of the muscle aren't well flowed (4). Muscle weakness is a clue to the disruption of the motor system at a point or several places from the control circuit from the motor neuron cell to the muscle fibers (10). In addition there are several risk factors that can be prevented in stroke patients to avoid a stroke. Risk factors that can be prevented include spherical grip is

an exercise to stimulate motion in the hand with the form of grip function training. This exercise is carried out through three steps, namely opening the hands, closing the fingers to grasp the object and to regulate the grip strength. This exercise aims to make the hand function can hold a round object like a ball on the palm of the hand, *Kinesio taping* can increase proprioceptive feedback so as to produce a position the right body, this is a very basic thing that is needed when training to restore the function of the extremities performed (12).

The results of the data analysis showed that $p = 0,000$, which means that there are significant differences between the mean muscle strength scores before and after being carried out according to Jemursari Islamic hospital standard in the control group. In the intervention group the researchers followed each day of exercise, a combination of spherical grip and *kinesio taping* exercises which were carried out for 20 minutes every day for 3 weeks, then the study assessed MMT scores (0-5). Whereas in the control group the researchers did not follow the exercises carried out by the patients. The constraints of exercise in the control group included delay for re-control due to constraints in transportation and accompanying families, besides that there were also patients who did not continue the exercises carried out with physiotherapy.

In the control group the increase in muscle strength is more influential because the combination of Spherical grip and *Kinesio taping* exercises can stimulate motor function through ball grip exercises. (*Spherical grip*) is a soft sensory modality and pressure on receptors of encapsulated end organ in the upper extremity. Then the response will be conveyed to the sensory cortex in the sensory pathway through the cell body on the C7-T1 nerve directly through the limbic system, in which the existing excitatory processing causes a very rapid response to the nerve to act on the

stimulus (13). Where as *Kinesio taping* through receptors in cutaneous can provide stimulation to the neuromuscular system in activating the performance of nerves and muscles when performing a functional motion. *Kinosio taping* will also facilitate mechanoreceptors to direct suitable movements and provide comfort in the paired area (12).

Muscle strength is the ability of the muscle to withstand the burden of both external and internal loads. Muscle strength is closely related to the neuromuscular system, namely how much the ability of the nervous system to activate the muscles to contract so that the more muscle fibers are activated, the greater the strength produced by these muscles, so that ischemic stroke patients use a combination of spherical grip and *kinesio taping* is neverdone to help increase muscle strength (4).

Wilcoxon and Mann Whitney test results The effect of a combination of Spherical grip and *Kinesio taping* exercises on increasing muscle strength in ischemic stroke patients In Jemursari Islamic hospital Surabaya.

Based on Table 3 the difference in the mean value of the delta muscle strength before and after administration after Spherical grip combination and *Kinesio taping* exercises in the treatment group was 2.83. The mean delta of muscle strength before and after administration after administering standard hospital exercises in the control group was 1.10. This means that the *Wilcoxon Signed ranks test* = 0,000 there is a significant difference between the delta difference in muscle strength before and after the combination of Spherical grip and *Kinesio taping* exercises in the intervention group and control.

In addition to decreasing muscle strength, stroke patients experience decreased coordination, decreased coordination of motion in stroke patients due to damage to the cerebellum caused by a lack of supply of blood flow to the brain (15). The combination of Spherical grip and *Kinesio taping* exercises used the voluntary movement and works with antagonistic groups in forming a movement.

In stroke patients in decreasing functional activity experiencing caused by a lack of blood flow to the brain causing death of tissue in the brain and tissues that are damaged will experience a decrease in work in accordance with their respective functions, especially in the tissues that regulate the motor area. Functional ability occurs due to the improvement of lesions that continue on the vascularization system. Furthermore, there is an improvement in the function of actional / sinasi activation that is not effective through Neural plasticity, namely the ability of the brain to modify and organize functions that have been damaged through sprouting, namely the part that has not been damaged will go to the part that experienced lesions, usmaking that is in normal circumstances not all synapses are active , because of the lesion in the main pathway the inactive part will replace the position that has the lesion (16). Repeated activities will become controlled and controlled movements so that giving exercise to stroke patients can accelerate the patient's recovery rate.

Exercise therapy is a method to overcome the problem of physical mobility after brain damage. *Kinesio taping* therapy can increase propeptive feedback so as to produce the correct

Table 3. Muscle Strength

Variable	n	Pre	Post	Delta	Information
Treatment	19	1,53	4,36	2,83	Significantly different
Control	19	1,42	2,52	1,10	Significantly different
<i>Wilcoxon Signed Ranks Test</i>					<i>p</i> =0,000

Primary data: 2018

body position; this is a very basic thing that is needed when exercising to restore the function of the extremities (17).

Intervention in action of giving a combination of spherical grip and *kinesio taping* exercises helps recovery of the part of the arm or part of the upper limb required a technique to stimulate the hand like a spherical grip exercise which is a functional hand by holding a round object like a ball on the patient's palm (13). *Kinesio taping* can increase nerve reseptor feedback so it produced the correct body position, this is a very basic thing that is needed when exercising to restore the function of the extremities performed (12).

CONCLUSION AND RECOMMENDATION

The effect of the combination of Spherical Grip and *Kinesio taping* Exercise on increasing muscle strength of ischemic stroke patients in Jemursari Islamic Hospital in Surabaya can be concluded that: The muscle strength of the respondents in the treatment group had a significant difference between before and after given a combination of Spherical grip and *kinesio taping* exercises. The muscle strength of the respondents in the control group also showed significant differences between before and after being given exercise according to the standard of care in the hospital. So that the combination of spherical grip and *kinesio taping* exercises affects the increase in muscle strength of ischemic stroke patients in Jemursari Islamic Hospital Surabaya. It is necessary to provide counseling to families and clients who experience ischemic stroke to increase knowledge in the ischemic stroke, in addition family assistance is also needed in improving damaged nerves the client ischemic stroke. For nursing services, room nurses can motivate and empower families to provide post-stroke training in the form of a combination of Spherical grip and kinesiotaping exercises to deal with muscle weakness in patients. The combination of Spherical grip and kinesiotaping

exercises can be used as a collaborative action between nurses and physiotherapy so that they can optimize rehabilitation programs for stroke patients who have neurological deficits.

REFERENCE

1. Jaimme Martin & Antonio Cuesta Vargas. 2013. *A Biomechanical Study Spherical Grip & Kekuatan Otot*.
2. Jongwoo Park, Na Jin Seo, Jaebum Son, Wheekuk Kim, Joono Cheong. 2013. *Postural Variation Of Hand Precision Grips Spherical Grip By Object Size*.
3. Junaidi, Iskandar. 2011. *Stroke Waspada! Ancamannya*. Yogyakarta: Andi.
4. Potter & Perry. 2005. *Fundamental Of Nursing Buku 1, Edisi 7*. Salemba Medika : Jakarta
5. Pinzon et al, 2010. *Awas Stroke Pengertian Gejala, Tindakan, Perawatan Dan Pencegahan*. Yogyakarta: Andi Offset
6. Irfan, Muhammad. 2010. *Fisioterapi Bagi Insan Stroke*. Graha Ilmu: Yogyakarta.
7. WHO, 2013, *Avoiding Heart Attacks and Strokes*; Diakses 20 Desember 2017.
8. Riskesdas. 2013. *Riset kesehatan dasar. Badan penelitian dan pengembangan kesehatan. Kementerian kesehatan RI*
9. Price, S. A. Dan Wilson, L. M. 2006. *Patofisiologi, Konsep Klinis Proses-proses Penyakit, Edisi 6, Volume 1*. Jakarta: EGC.
10. Kadek, Sukawana, Wayan, Ketut., 2014. *Manajemen Stroke*.
11. Mubarak, W.I. (2008), *Ilmu Keperawatan Medikal Bedah*, Jakarta.
12. Andarwati, NA. 2013. *Pengaruh Latihan Rom Terhadap Peningkatan Kekuatan Otot Pasien Hemiparase Post Stroke Di RSUD DR. Moerdi Surakarta*. Skripsi: Fakultas Ilmu Kesehatan Universitas Muhammadiyah Surakarta. Dinkes 27 November 2016 dari http://eprints.ums.ac.id/26024/Naskah_Publikasi.Pdf.

13. Andrea Robertson, Jean Deits 2017, *A Description Spherical Grip Strength Preschool Children*.
14. Sukmaningrum, F. 2010. Efektifitas Range of Motion Aktif-Asistif : Spherical Grip Terhadap Peningkatan Kekuatan Otot Ekstremitas Atas Pada Pasien Stroke Di RSUD Tugurejo Semarang.
15. Dimas S.I, Nyoman A, M. Irfan. *Metode Konvensional, Kinesio taping, Dan Motor Relearning Programme Berbeda Efektifitas Dalam Meningkatkan Pola Jalan Pasien Post Stroke Di klinik Ontoseno Malang*. Diakses 15 Desember 2017.
16. Prok, Gessal & Angliadi. 2016. *Pengaruh Latihan Gerak Aktif Menggenggam Bola Pada Pasien Stroke Diukur Dengan Handgrip Ynamometer*. Jurnal e-<http://ejournal.unsrat.ac.id/index.php/eclinik/view/1039>.
17. Warlow, C. 2007. *Evidence-Based Neurology: Management Of Neurological Disorders*. Edited by Livia Candelise, Blackwell Publishing Pages 11-14.
18. Rojo, N. 2011. *Music Supported Therapy Induces Plasticity In Sensorimotor Cortex in Chronic stroke : A Single Case Study Using Multimodal Imaging (fMRI-TMS)*. *Brain Injury* : 25(78):787-93. Di unduh dari <http://www.ncbi.nlm.nih.gov/pubmed/21561296> diakses pada 20 september 2017
19. Rusdiyanto, S. 2010. *Anda Bertanya Dokter Menjawab: Stroke dan Rehabilitasi Pasca Stroke*. Jakarta : Buana Ilmu Populer
20. O'sullivan, 2010. *Definisi Balance*
21. <http://dhaenkpdedro.wordpress.com/keseimbangan-balance/>. (di akses september 2017).
22. Abdurasyid. 2013. *Penggunaan Kinesio tape Selama Tiga Hari Tidak Berbeda Dengan Perikat Placebo Dalam Mengurangi Resiko Cedera Berulang Dan Derajat Q-Angle Pada Penderita Patellofemoral Pain Syndrom*. Tesis. Udayana.
23. Ari Sudarsono, 2011. *Peregangan Otot-Otot Paha Dan Slumptest*. Diakses 15 Desember 2017. <http://www.bps.go.id>.
24. Desi Ida L, 2015. *Pemberian Range Of Motion (ROM) Aktif-Asitif : Spherical Grip Terhadap Peningkatan Kekuatan Otot Ekstremitas Atas Pada Asuhan Keperawatan Tn.W Dengan Stroke Di Ruang Anyelir RSUD Dr. Soediran Mangun Sumarso Kabupaten Wonogiri*.
25. Dharma, Surya. 2010. *Manajemen Kinerja, Falasafah Teori Dan Penerapannya*. Pustaka Pelajar. Yogyakarta.
26. Dinkes Jawa Timur, 2013. *Profil Kesehatan Jawa Timur 2013*. Surabaya.
27. Dongoes, Marilyn E, 2002. *Rencana Asuhan Keperawatan*,. Ed 3. Jakarta: EGC.
28. Engineering & Harris,. 2009. *Primary Care Providers Views Of Challenges And Rewards Of Dementia Care Relative To Other Condition, Departement Of Neurology*.
29. Federica Tamburella, Giorgio Scivoletto and Marco Molinari 2014. *Somatosensory Inputs By Application Of Kinesiotaping*.
30. Ganong, William F, 2003. *Fisiologi Saraf & Sel Otot*. Jakarta: EGC.
31. Ginsberg Lionel, 2007. *Lecture Notes Neurology*. Jakarta; Erlangga.
32. Goodridge Sherly. 2010. *Taping The World For Health*. (<http://goeata.org/protected/EATACD10/downloads/pdf/presentation-goodridge.pdf> diakses 15 Agustus 2016).
33. Guilhaume, A., 2011. *Aplikasi Kinesio taping*,. *Jurnal of Musculokeletal*.
34. Guyton A.C. & J.E. Hell, 2007. *Buku Ajar Fisiologi Kedokteran*. Edisi 9. Jakarta: EGC.
35. Harsono. 2007. *Kapita Skeletal Neurologi*. Edisi ke-2. Yogyakarta: Gajah Mada University Press.
36. Henrique Couto Da Gama Magalhaes, Kenia Kiefer Parreiras De Menezes, Patric Roberto Avelino 2017. *Effect Of The Kinesio Taping On The Gait Of Stroke Subjects: Systematic Review With Meta-Analysis*.

37. Irawan, D. S., Adiputra, N., Irfan, M., Fisioterapi, P., Malang, U. M., ... Programme, M. R. (2014) *Metode Konvensional, Kinesiotaping, Dan Motor Relearning Programme Berbeda Efektivitas Dalam Meningkatkan Pola Jalan Pasien Post Stroke Relearning Programme Has Different Efficacy On Improving Gait Pattern Of Post Stroke Patient In*, 2(1).
38. Kase, K. Wallis, J. Kase, T. 2003. *Clinical Therapeutic Applications Of The Kinesio taping Method 2nd Edition*. Jepang. KenkaiCo.
39. Kosmadakis, G.C., & Medcalf, J.F. 2008. *Sleep Disorders In Dialysis Patients. In J ArtifOrgans*; 31.11:919-27.
40. Lesmana, Syahmira Indra, 2013. *Perbedaan Pengaruh Latihan Beban Terhadap Kekuatan Dan Daya Tahan Otot Biceps Brachialis Ditinjau Dari Perbedaan Gender (Studi Komparasi Pemberian Latihan Beban Metode Delorme Dan Metode Oxford Pada Mahasiswa Fakultas Ilmu Kesehatan Dan Fisioterapi*. Diakses tanggal 15 Mei 2017.
41. Linton, A.D., Matteson, M.A & Maebius N.K (2007). *Introduction Nursing Care Of Adult*. Saunders Company.
42. Lisa Lukens, Ann Bush (1995) *Spherical Strenght In Children 3 To 6 Years Of Age*.
43. Lukman dan Ningsih. 2012. *Asuhan Keperawatan Pada Klien Dengan Gangguan Sistem Muskuloskeletal. Jilid 1*. Jakarta : Salemba Medika
44. Lumbantobing, S.M. 2008. *Neurologi Klinik: Pemeriksaan Fisik Dan Mental*. Cetakan ke-11. Jakarta : Balai Penerbit FKUI.
45. Moon-Hwan Lee, PT, PhD; Sang –Yeol Ma, PT, MS1; Seong-Hak, Kim, PT, PhD2; Rae-Joon Park, PT, Phd3 2007. *Effect Kinesio Therapy Patients Stenosing Tenosynovitis*.
46. Mostafavifar, M. Wertz, J. Borchers, J. 2012. *A Systematic Review Of The Effectiveness Of Kinesio Taping For Musculoskeletal Injury*. Columbus. *The Physician and Sport Medicine*. 2012 Nov; 40(4):33-40. Available from : <http://www.ncbi.nlm.nih.gov/pubmed/23306413>.
47. Nurussalam., 2013. *Metodologi Penelitian Kuantitatif dan Kualitatif*. Jakarta: EGC.
48. Perdossi, 2011. *Perhimpunan Dokter Spesialis Saraf, Ilmu Penyakit Saraf*.
49. Prentice, William E. 2011. *Principle of Athletic Training : a Competency- Based Approach 14th Edition*. New York ; The Mc Graw-Hill. p.232-23.
50. Saryono, 2011. *Metodologi Penelitian Kesehatan.*, Yogyakarta: Mitra Cendikia Press.
51. Sastroasmoro, Sofyan, I. *Dasar-Dasar Metodologi Penelitian Klinis Edisi Ke-5*. Jakarta : CV Sagung Seto. 2014. p:130-7, 325-17.
52. Setyopranoto, ismail. 2012. *Oedem Otak Pada Pasien Stroke Iskemik Akut*. Yogyakarta : Balai Penerbit FKUGM
53. Sloane, E. 2004. *Anatomi dan Fisiologi Untuk Pemula*. Penerbit Buku. Kedokteran (EGC). Jakarta.
54. Smeltzer, Suzanne C dan Bare, Brenda G. 2013. *Keperawatan Medikal Bedah Brunner & Suddarth Ed:12*, Jakarta: EGC
55. Smeltzer, S. C., & Bare, B. G. 2002. *Buku Ajar Keperawatan Medikal Bedah*. Jakarta: EGC
56. Suratun, 2008. *Asuhan Keperawatan Range Of Motion*. Jakarta. EGC.
57. Tsai, Chien-Tsung, Wen-Den Chang; Jen-Pei Lei. 2010. "Effect of short-term Treatment with Kinesio taping for Plantar, Fasciitis". *Jurnal of Musculokeletal pain*. 18(1), 71-80.
58. Victoria, Arlies Z, dkk. 2014. *Pengaruh Latihan Lateral Prehension Grip Terhadap Peningkatan Luas Gerak Sendi (LGS) Jari Tangan Pada Pasien Stroke Di RSUD DR.H. Soewondo Kendal*.
59. Wahyudin. 2008. *Aplikasi Spherical Grip*. Jakarta. EGC
60. Watson. R. 2002. *Anatomidan Fisiologi*. Edisi 10. Buku Kedokteran EGC. Jakarta. Hal 303.

61. Wiwit S, 2012. *Stroke dan Penanganannya Memahami, Mencegah dan Mengobati Stroke*. Jogjakarta: Kata hati
62. Yasa, Doantara. 2008. *Falsafah Teori Dan Penerapannya*. Pustaka pelajar, Yogyakarta.
63. Yastrki. 2006. *Tingkat Terjadinya Stroke Di Indonesia*. www. Yastroki.or.id.
64. Young-Hyeon Bae, Hyeong Geun Kim, Kyung Sam Min, and Suk Min Lee 2015. *Pengaruh Kinesio Taping Kaki Bawah Mendengarkan Kemampuan Neraca di Indonesia Pasien Stroke Dengan Foot Drop*.