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THE EFFECT OF RANGE OF MOTION EXERCISE ON EXTREMITY MUSCLE STRENGTH IN NON-HEMORAGIC STROKE PATIENTS

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ABSTRACT

Blockage of a blood vessel causes a cut in the supply of oxygen and nutrients resulting in damage to brain tissue. Stroke symptoms usually appear suddenly with loss of muscle strength in one or both extremities. One intervention to increase muscle strength in stroke patients is Range Of Motion exercise. The purpose of this case study is to determine the effect of Range Of Motion exercises on muscle strength in patients with non-hemorrhagic stroke disease. The method in this case study is to interview the patient's family about the disease and health before entering the hospital and assess muscle strength before range of motion exercises are carried out. Data was collected in this study by looking at medical records and interviewing the patient's family, and The method used is a case study in patients with muscle weakness in the lower and upper extremities and given range of motion exercises and evaluated the increase in muscle strength after implementation. The results of the case study after the intervention of Range Of Motion exercises there was an increase in muscle strength in non-hemorrhagic stroke patients. In the results of this case study there was an increase in muscle strength after the intervention, so that Range Of Motion exercises were considered very effective.

Kata kunci: muscle strength; non hemorrhagic stroke; range of motion

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INTRODUCTION

Blockage of blood vessels causes a cut off of the supply of oxygen and nutrients which results in damage to brain tissue (Angina Widyaswara et al., 2019). Stroke is divided into two, namely non-hemorrhagic stroke and non-hemorrhagic stroke. Hemorrhagic stroke is a rupture of blood vessels while ischemic or non-hemorrhagic stroke is a disruption of blood flow to the brain which causes blood flow to the brain to stop and cholesterol buildup on the walls of blood vessels (Olviani et al., 2020). Stroke symptoms usually appear suddenly and include loss of strength on one side of the body, changes in consciousness, slurred speech, blurred vision, difficulty walking, headaches and loss of balance (Supriadi et al., 2022.). Classifying risk factors for stroke into two categories, namely modifiable risk factors and unmodifiable risk factors (Agustin et al., 2022.). Modifiable risk factors include high blood pressure, diabetes, cholesterol, obesity, heart disease, smoking, excessive alcohol consumption, drug abuse, and difficulty sleeping. Unmodifiable risk factors such as age, gender, race, genetics, and history (Nugroho, 2024).

Data obtained from WHO (World Health Organization) in 2017 as many as 1.5 million people experienced stroke (Maelani et al., 2022a) According to the Ministry of Health of the Republic of Indonesia, the incidence of stroke from 2013 to 2018 has increased, namely in 2013 by 7.0% while in 2018 it increased to 10.9% with specifications of 11.0% men and

10.9% women (Supriadi et al., 2022.) According to the American Heart Association in 2019 there were 17 million cases of stroke and 6.6 million deaths in various countries (Syauqy et al., 2023)

Patients who have had a stroke will experience limited mobility, namely not being able to move their limbs freely. Hemiparesis is a unilateral weakness that causes decreased muscle tone and subsequent immobilization on the affected side of the body. Lack of treatment for prolonged immobilization can lead to various complications (Setyawati & Retnaningsih, 2024). Range of motion exercises are divided into two, namely active movement exercises and passive movement exercises. Active movement exercises are conditions where the patient can move all joints without assistance and passive movement exercises are conditions where the patient cannot move all joints independently and must get help from family members or nurses (Supriadi et al., 2022.). An alternative to influence and improve joint mobility in the upper and lower extremities in stroke patients is with passive range of motion exercises. Range of motion exercises are exercises that maintain or increase range of motion that aim to build muscle tone and muscle strength by increasing the ability to move joints fully and normally (Supriadi et al., 2022.)

Range Of Motion exercises are usually performed on semi-comatose and unconscious patients, patients with limited mobility, unable to perform some or all Range Of Motion exercises independently, patients on total bed rest or patients with total limb paralysis (Faridah et al., 2022). Range of motion is a rehabilitation process that is considered quite effective in preventing disability in stroke patients (Purba et al., 2022). The benefits of range of motion exercises include training muscle tone, improving blood circulation, increasing muscle, joint and nerve stimulation to respond to motoric muscle tone functions, maintaining or increasing muscle strength, preventing deformity and improving blood circulation (Shinta Kusuma dan Oktavia Sara, 2020)Research shows that Range Of Motion Exercises change from scale 2 to scale 3 after three days of receiving range of motion exercises (Agustin et al., 2022.) This is why "The Effect of Range of Motion (ROM) Exercises on Extremity Muscle Strength in Non-Hemorrhagic Stroke Patients" is an interesting case study topic for researchers to study stroke patients. The purpose of this case is to determine the effect of Range Of Motion exercises on muscle strength in non-hemorrhagic stroke patients.

METHOD

This report uses a case study method, to seek new knowledge about the problems of non-hemorrhagic stroke patients in the ward by providing range of motion exercise interventions, to increase muscle strength in the extremities that are experiencing weakness. The provision of interventions that are currently in the ward of UNS Hospital in February 2023 and assessment and nursing care were carried out for 1 day. The subjects in this case study were patients who had a stroke with weakness of the limbs in the ward and the number of patients to be carried out was 1 patient. This case study is equipped with Informed Consent as approval from the patient or family to carry out range of motion exercise interventions, and to carry out interventions according to the range of motion SOP as a reference.The method in this case study is to interview the patient's family about the disease and health before entering the hospital and assess muscle strength before range of motion exercises are carried out. Data was collected in this study by looking at medical records and interviewing the patient's family.This case study involves patients doing passive range of motion exercises. Range of motion exercises are carried out for twenty-five minutes to thirty minutes with a repetition frequency of five to seven times. After being given range of motion exercises, the patient will be evaluated and the results of the increase in muscle strength will be recorded. Move the

range of motion exercises starting from shoulder flexion _ extension (lift the arm from the side of the body up, then return to the original position), abduction - adduction (lift the arm and move it to the side of the body, then return to the original position). Move wrist flexion - extension - hyperextension (bend the palm down, then straighten it then bend it up, and Pull), Radial flexion - ulnar flexion (bend the palm up then move it sideways towards the thumb and sideways towards the little finger). Next, move the fingers and toes Flexion - extension (hold the fingers then straighten them), Abduction - adduction (stretch then close the fingers again). The last movement on the feet Abduction - adduction (move the feet away from the body then move them in the opposite direction).

RESULTS

Case Overview

A patient case named Mrs. W, 70 years old with complaints of weakness in the upper and lower limbs since 1 day before admission to the hospital, slurred speech. There were blisters on the thighs and buttocks since 1 week before admission to the hospital, the patient has a history of diabetes mellitus, HHD (Hypertensive Heart Disease), and stroke 1 month ago. Vital signs obtained after conducting an assessment were BP: 180/92 mmHg, RR: 20 x / minute, N: 69 x / minute, S: 36, SpO2: 100%. The patient's level of consciousness was somnolent, GCS 8 E2V3M3.

Nutritional and Fluid Balance

The patient was fitted with an NGT with a size of 16 and a depth of 55 cm. The patient was given a liquid diet with a frequency of 1 day 3 times with a total of 200 ml for each meal. The patient's weight is 60 kg with a height of 157 cm, BMI 24.3 Normal.

Elimination

The patient has a urine catheter installed with a size of 16 and a 20 cc lock. The frequency of urine output is around 450cc - 500cc / 24 hours. The patient's urine is brownish yellow, and the patient has only had 1 bowel movement during his stay in the hospital.

Supporting Examination

The results of the laboratory examination on February 10, 2024, are shown in table 1.

Table 1.
Laboratory Examination Results

Examination Name	Results	Normal value
Hemoglobin	9.0	12.0 – 15.6
Hematokrit	27	35 – 45
Lekosit	15.74	4.50 – 11.00
Eritrosit	3.17	4.10 – 5.10
RDW-CV	17.4	11.6 – 14.6
Neutrofil Lymphocite Ratio	5.44	1.00 – 3.13
Limfosit	13.7	22.0 – 44.0
Neutrofil	74.4	50.0 – 70.0
Eusinofil	7.3	0.0 – 2.0
Ureum	119	10 – 45
Kreatinin	6.38	0.50 – 1.10
Kalium	3.45	3.50 – 5.50
Chlorida	109.00	96.00 – 106.00
Albumin	2.0	3.2 – 4.6
Glukosa Strip Sewaktu	139	70 - 140

Thorax X-ray Results, February 10, 2024

1. Cardiomegaly (LV), accompanied by aortic arch classification

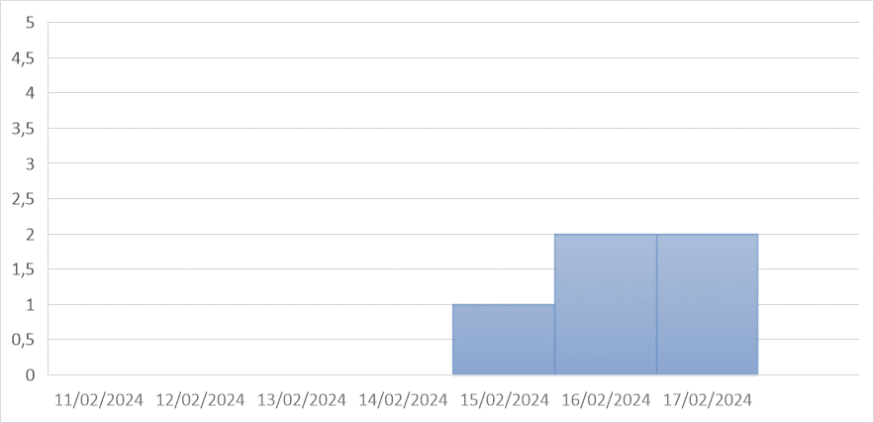
2. Bronchitis picture
3. No right and left hilar lymphadenopathy Head CT Scan Results, January 7, 2024
4. Left cerebral infarction (thalamus)
5. Cerebral atrophy
6. Multisinusitis (bilateral maxillary, bilateral sphenoidal and bilateral ethomoidal)

Nursing Diagnosis

Based on the assessment that has been carried out, the nursing diagnosis that is established is impaired physical mobility related to decreased muscle strength (D.0054)

Nursing Plan

Nursing plan for patients with complaints of weakness of the limbs in non-hemorrhagic stroke, so that the patient's muscle strength decreases. by implementing range of motion exercises, it can increase muscle strength with the Nursing plan procedure: Shoulder exercises : Flexion – extension, lift the arm from the side of the body up, then return to its original position. Abduction – adduction, lift the arm and move it to the side of the body, then return to its original position. Wrist exercises : Flexion - extension - hyperextension: bend the palm down, then straighten it then bend it up, and Pull. Radial flexion - ulnar flexio, bend the palm up then move it to the side towards the thumb and to the side towards the little finger. Exercises on the fingers and toes : Flexion – extension, grasp the fingers then straighten them. Abduction – adduction, stretch then close the fingers again. Foot exercises : Abduction – adduction, move the foot away from the body then move it in the opposite directionRepeat the above movements slowly (do the movements 1 day 2 times), if the patient feels pain, please stop the movement. The patient did range of motion exercises, there was an increase in muscle strength. On the first day to the fifth day there was no increase in muscle strength, but when entering the sixth day of training, the patient had an increase in muscle strength. The results of the increase in muscle strength are shown in the following image.



Picture 1. Results of Muscle Strength Assessment After Intervention

Evaluation

On the first day to the fifth day after the range of motion exercise intervention from February 10 to February 14, 2024, there was no increase in muscle strength, especially in the lower extremities, because the patient's lower extremities had decubitus wounds on the thighs and buttocks. Evaluation on the sixth day, February 15, 2024 at 16:00 WIB, there was a family response stating that the patient's upper extremities were observed to experience muscle contractions without movement, but there was no increase in muscle strength in the lower extremities. On the seventh day, February 16, 2024 at 08:00 WIB, which stated that the patient experienced muscle contractions in the lower extremities but there was no movement.
On the eighth day, February 17, 2024 at 12:00 WIB, a family response was obtained, namely

that the patient's upper extremities had slow movements, but the movements could not be moved freely, for example, moving up or down. After carrying out range of motion exercises, there was a visible change in physical mobility, with the criteria being increased limb movement and increased muscle strength.

DISCUSSION

Non-hemorrhagic stroke patients often experience neuromusculoskeletal problems that can limit range of motion. Due to reduced muscle strength, balance, and coordination after a stroke, walking can be a challenge for patients, making daily activities more difficult (Agonwardi & Budi, 2016). One of the clinical signs and symptoms of stroke is paralysis of the limbs (Eka et al., 2019). Because stroke can affect anyone, men or women, young or old with an age range of 35 to 85 years, this condition is worrying (Leniwia et al., 2019). Mobility is influenced by a number of factors, starting from lifestyle. An unhealthy lifestyle such as diet, exercise patterns, and limited mobility can have a negative impact on a person's mobility. Age and developmental stage can also affect, for example, as a person gets older, muscle strength can decrease (Maljuliani et al., 2023). Based on the results of a case study that has been conducted on patient Mrs. W, it shows that the patient experienced weakness of the limbs which was characterized by a decrease in muscle strength values. Analysis of patient data Mrs. W on the first day before being given range of motion exercises, the patient experienced a decrease in muscle strength and the patient's muscle strength value was 0, which means no muscle strength at all. After range of motion exercises were carried out for 8 days with a frequency of 16 times, the patient experienced an increase in muscle strength, for upper extremity muscle strength the increase was 2, which means there was movement but the movement could not fight gravity. Lower extremity muscle strength increased only by 1, which means there was muscle contraction but no movement. The purpose of range of motion exercises is to prevent contracture or muscle stiffness and to improve neurological function (Sholihany et al., 2021)

Providing range of motion and tilting exercises to the right and left is one type of rehabilitation exercise that is very successful in increasing motor activity and reducing disability in stroke patients ((Eva Agustina et al., 2021). Decreased joint elasticity and muscle atrophy can be avoided with ROM exercises. To assess the ability of joints and muscles to move, increase muscle tone, prevent joint stiffness and improve blood circulation, physical exercise is very important for non-hemorrhagic stroke patients (Hardika et al., 2020). The idea of range of motion exercises is to train the muscles of the neck, fingers, arms, elbows, shoulders, legs and ankles, at least twice a day with care and prevent patients from getting tired quickly. ROM exercises should be done according to time, such as after bathing or routine care. ROM can train muscle tone and improve blood circulation and if ROM is done regularly and done in a relaxed manner it will increase muscle stimulus, joints and nerves, to respond to the motoric function of muscle tone in the trained extremities (Agusrianto & Rantesigi, 2020). This is in accordance with a case study conducted by Melinia Nira and Erika Dewi (2024), muscle strength after getting ROM exercises for 5 days, done 2 times in the morning and evening, the results showed an increase in muscle strength in both patients. Before being given the exercise, Mrs. S got a ratio of 0: 2 and the second patient Mr. A got a ratio of 1: 2, muscle strength increased after being given ROM (Nira Natasya & Dewi Nooratri, 2024a)

This is in accordance with Kristiani's research (2018) on the effect of range of motion exercises on muscle strength in stroke patients in the Sidotopo Surabaya Health Center area. The results of the study showed that after one month of range of motion exercises, the muscle

strength of stroke patients increased from scale 3 to scale 4 and from scale 4 to scale 5. This exercise was carried out twice for five days (Kristiani et al., 2017) This study is supported by research by Nira Natasya and Dewi Nooratri (2024) on the effect of passive ROM on changes in muscle strength in stroke. According to the researchers, after ROM was carried out twice a day for five days, namely in the morning and evening, the patient's muscle strength scale was at number 2. Both patients experienced an increase in power and muscle strength (Nira Natasya & Dewi Nooratri, 2024). This study is also in line with Rahmadani and Rustandi (2019), from a sample of 20 respondents it was concluded that ROM is very useful in increasing muscle endurance in non-hemorrhagic stroke patients who experience disorders in their limbs (Rahmadani & Rustandi, 2019). The patients studied received intervention, namely range of motion exercises to increase muscle strength. Patients were evaluated for 8 days with a frequency of 16 consecutive times. The effects of range of motion exercises aim to increase muscle strength and avoid or prevent recurrent strokes (Rahmadani & Rustandi, 2019b). When someone has a stroke, they are more likely to experience problems with their limbs, which limits and inhibits their range of motion (Jessyca et al., 2021) Patients who have a stroke and experience paralysis on one side of the limb, they cannot move because their muscles lose muscle tone. Untreated immobilization can result in complications such as abnormal tone, orthostatic hypotension, deep vein thrombosis and contractures (Nira Natasya & Dewi Nooratri, 2024). One of the reasons why stroke patients have lower joint mobility is the occurrence of contractures (Hardika et al., 2020b).

ROM exercise therapy is one of the advanced therapies for stroke patients which aims to increase cerebral blood flow, minimize the resulting smallpox to improve sensory motoric function (Lee & Kim, 2020). This is in line with research conducted by Nonok Karlina, Erida Fadila, Fega Nurpuji (2023) namely ROM can provide a greater effect on the motoric function of the extremities in stroke patients (Karlina et al., 2023). The results given after doing ROM exercises are maintaining flexibility and muscle strength, maintaining joint mobility and preventing deformity, stiffness and contracture. Patients with hemiparase stroke are immediately treated with curative measures such as medication, rehabilitative measures with physiotherapy in the form of passive or active ROM exercises (Indrawati et al., 2019). The success of ROM must be influenced by the patient's compliance and willingness to increase muscle strength.

CONCLUSION

Based on research conducted at UNS Hospital, an assessment has been conducted on Mrs. Unknowingly, GCS 7 E2V3M2, there is weakness of the upper and lower extremities. The diagnosis of the disorder is a physical mobility disorder with ROM (Range Of Motion) exercises carried out 2 times a day for 8 days. The results of the ROM exercise are that on the first day before the procedure the patient had muscle strength in the upper and lower extremities 0: total paralysis, no muscle strength at all. On the fourth day, there was a change in upper extremity muscle strength, namely 1: no movement, but there was muscle contraction when palpated and in the lower extremities muscle strength was exactly 0. On the eighth day, there was an increase in upper and lower extremity muscle strength, the value of muscle strength in the upper extremities was 2: there was movement, but this movement was unable to fight gravity. And for the value of muscle strength in the lower extremities 1: no movement, but there was muscle contraction when palpated. Based on the results and conclusions, families or nurses should do ROM exercises, because these exercises help stroke patients avoid permanent paralysis. It is hoped that in further research, this case study can be conducted with a diverse number of participants.

REFERENCES

Agonwardi, A., & Budi, H. (2016). Pengaruh Pendidikan Kesehatan Tentang Latihan Range of Motion (ROM) Terhadap Keterampilan Keluarga Dalam Melakukan ROM Pada Pasien Stroke Di Bangsal Syaraf RSUP Dr M.Jamil Padang Tahun 2013. Jurnal Endurance, 1(1), 47. https://doi.org/10.22216/jen.v1i1.1030

Agusrianto, A., & Rantesigi, N. (2020). Application of Passive Range of Motion (ROM) Exercises to Increase the Strength of the Limb Muscles in Patients with Stroke Cases. Jurnal Ilmiah Kesehatan (JIKA), 2(2), 61–66. https://doi.org/10.36590/jika.v2i2.48

Agustin, T., Susanti, I. H., & Sumarni, T. (n.d.). Implementasi Penggunaan Range Of Motion (ROM) terhadap Kekuatan Otot Klien Stroke Non Hemoragik.

Eka, W., Syahrim, P., Ulfah Azhar, M., Negeri, U. I., Makassar, A., & Penulis, K. (2019). The Indonesian Journal of Health Promotion Open Access Efektifitas Latihan ROM Terhadap Peningkatan Kekuatan Otot Pada Pasien Stroke: Study Systematic Review Effectiveness of ROM Exercise Against Increased Muscle Strength in Stroke Patients: Study Systematic Review. MPPKI, 2(3). https://doi.org/10.31934/mppki.v2i3

Agustina, R. E., Fitri, N. L., & Purwono, J. (2021). Efektifitas Latihan Range Of Motion Cylindrical Grip terhadap Kekuatan Otot Ekstermitas Atas Pada Pasien Stroke Non Hemoragik Di Ruang Syaraf Rsud Jend. Ahmad Yani Metro. Jurnal Cendikia Muda, 1(4), 554-563.

Faridah, A. A., Noor Istiqomah, I., Kurnianto, S., & Khovifah, N. (2022). The Effectiveness of Range of Motion (ROM) on Increasing Muscle Strength in Stroke Patients: Literature Review. Nursing and Health Sciences Journal (NHSJ), 2(2), 137–142. https://doi.org/10.53713/nhs.v2i2.118

Hardika, B. D., Yuwono, M., & Zulkarnain, H. (2020). Faktor Risiko yang Mempengaruhi Terjadinya Stroke Non Hemoragik pada Pasien di RS RK Charitas dan RS Myria Palembang. Jurnal Akademika Baiturrahim Jambi, 9(2), 268. https://doi.org/10.36565/jab.v9i2.234

Indrawati, ., Sudiana, I. K., & Sajidin, M. (2019). Active, Passive, and Active-Assistive Range of Motion (ROM) Exercise to Improve Muscle Strength in Post Stroke Clients: A Systematic Review. 329–337. https://doi.org/10.5220/0008324803290337

Kristiani, R. B., Keperawatan, A., & Husada, A. (2017). Pengaruh Range Of Motion Exercise Terhadap Kekuatan Otot Pada Pasien Stroke Di Wilayah Puskesmas Sidotopo Surabaya. In Jurnal Ners Len Tera (Vol. 5, Issue 2).

Lee, S.-M., & Kim, D.-H. (2020). Effects of sensory stimulation on upper limb strength, active joint range of motion and function in chronic stroke virtual reality training. Phys Ther Rehabil Sci, 2020(3), 171–177. https://doi.org/10.14474/ptrs.2020.9.3.171&domain=pdf&date_stamp=2020-9-25

Leniwia, H., Prabawati, D., Hary Susilo, W., Prodi, D. D., & Fakultas Vokasi UKI Jakarta, K. (2019). Pengaruh Latihan Range Of Motion (Rom) Terhadap Perubahan Aktivitas Fungsional Pada Pasien Stroke Rawat Inap Di Rsu Uki Jakarta. Universitas Muhamadiyah Tangerang, 4.

Maelani, W. S., Fitriyah, E. T., Camelia, D., Roni, F., Wijaya, A., Bahrul ', S., & Jombang, U. (2022). Penerapan Intervensi Range Of Motion (Rom) Pasif Ekstermitas Kiri Pada Pasien Stroke Non Hemoragik Dalam Mengatasi Masalah Gangguan Mobilitas Fisik Implementation Of Left Extermity Passive Range Of Motion (Rom) Intervention In Non-Hemorrhagic Stroke Patients In Treating The Problems Of Physical Mobility Disorders. In Journal Well Being (Vol. 7, Issue 2). http://journal.stikes-bu.ac.id/

Maljuliani, D., Harun, H., Ulfah Rifa, S., Fitri, atul, Ners, P., Keperawatan, F., Padjadjaran, U., & Keperawatan Medikal Bedah, D. (2023). Latihan Range Of Motion (Rom) Terhadap Kekuatan Otot Pasien Stroke Hemoragik: Studi Kasus. In Jurnal Riset Ilmiah (Vol. 2, Issue 9).

Nira Natasya, M., & Dewi Nooratri, E. (2024a). Penerapan Latihan Range Of Motion (ROM) Pasif Terhadap Perubahan Kekuatan Otot Ekstremitas Pada Pasien Lansia Dengan Kasus Stroke Di Rumah Sakit Umum Daerah (RSUD) Dr. Soediran Mangun Sumarso Wonogiri. Jurnal Kesehatan Dan Kedokteran, 1(2), 148–154. https://doi.org/10.62383/vimed.v1i2.186

Nira Natasya, M., & Dewi Nooratri, E. (2024b). Penerapan Latihan Range Of Motion (ROM) Pasif Terhadap Perubahan Kekuatan Otot Ekstremitas Pada Pasien Lansia Dengan Kasus Stroke Di Rumah Sakit Umum Daerah (RSUD) Dr. Soediran Mangun Sumarso Wonogiri. Jurnal Kesehatan Dan Kedokteran, 1(2), 148–154. https://doi.org/10.62383/vimed.v1i2.186

Nugroho, F. A. (2024). Intervensi Keperawatan Kombinasi ROM Aktif dan Squishy pada Pasien Post Stroke dengan Hambatan Mobilitas Fisik. Jurnal Penelitian Inovatif, 4(1), 21–28. https://doi.org/10.54082/jupin.260

Olviani, Y., Maulana, I., & Salmah, S. (2020, July 23). The Effect Of Passive Range Of Motion (ROM) on Increasing Elbow Joint Angles of Stroke Patients. https://doi.org/10.4108/eai.23-11-2019.2298373

Park, M., Ko, M. H., Oh, S. W., Lee, J. Y., Ham, Y., Yi, H., Choi, Y., Ha, D., & Shin, J. H. (2019). Effects of virtual reality-based planar motion exercises on upper extremity function, range of motion, and health-related quality of life: A multicenter, single-blinded, randomized, controlled pilot study. Journal of NeuroEngineering and Rehabilitation, 16(1). https://doi.org/10.1186/s12984-019-0595-8

Peningkatan Kekuatan Otot pada Pasien Stroke, T., Andriani, D., Fitria Nigusyanti, A., Nalaratih, A., Yuliawati, D., Afifah, F., Amatilah, F., Firmansyah, A., & Supriadi, D. (n.d.). Pengaruh Range Of Motion (Rom) Terhadap Peningkatan Kekuatan Otot Pada Pasien Stroke.

Purba, S. D., Sidiq, B., Purba, I. K., Hutapea, E., Silalahi, K. L., Sucahyo, D., & Dian, D. (2022). Efektivitas ROM (Range of Motion) terhadap Kekuatan Otot pada Pasien Stroke di Rumah Sakit Royal Prima Tahun 2021. JUMANTIK (Jurnal Ilmiah Penelitian Kesehatan), 7(1), 79. https://doi.org/10.30829/jumantik.v7i1.10952

Rahmadani, E., & Rustandi, H. (2019). Peningkatan Kekuatan Otot Pasien Stroke Non Hemoragik dengan Hemiparese melalui Latihan Range of Motion (ROM) Pasif. Journal of Telenursing (JOTING), 1(2), 354–363. https://doi.org/10.31539/joting.v1i2.985

Suwaryo, P. A. W., Widodo, W. T., & Setianingsih, E. (2019). Faktor risiko yang mempengaruhi kejadian stroke. Jurnal Keperawatan, 11(4), 251-260.

Setyawati, V. Y., & Retnaningsih, D. (2024). Penerapan Range of Motion pada pasien stroke dengan gangguan mobilitas fisik. Jurnal Manajemen Asuhan Keperawatan, 8(1), 18–24. https://doi.org/10.33655/mak.v8i1.179

Shinta Kusuma dan Oktavia Sara Akademi Keperawatan Ngesti Waluyo Jawa Tengah, A. (2020). Penerapan Prosedur Latihan Range Of Motion (Rom) Pasif Sedini Mungkin Pada Pasien Stroke Non Hemoragik (Snh). 5(10). https://doi.org/10.36418/syntax-literate.v5i10.1706

Sholihany, R. F., Waluyo, A., & Irawati, D. (2021). Latihan ROM Pasif Unilateral dan Bilateral terhadap Peningkatan Kekuatan Otot Akibat Stroke Iskemik. Jurnal Keperawatan Silampari, 4(2), 706–717. https://doi.org/10.31539/jks.v4i2.1920

Syauqy, A., Wiragapa, L. R., Soekatri, M. Y. E., Ernawati, F., Nissa, C., & Dieny, F. F. (2023). Hubungan Antara Pola Makan Dan Kondisi Penyerta Dengan Prevalensi Strok Pada Usia Dewasa Di Indonesia: Analisis Data Riskesdas 2018. Gizi Indonesia, 46(1), 121–132. https://doi.org/10.36457/gizindo.v46i1.785