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The Effect of Range of Motion Exercises on Functional Independence and Activities of Daily Living in Patients with Acute Stroke: A Randomized Controlled Study

Akut İnmeli Hastalarda Eklem Hareket Açıklığı Egzersizlerinin Fonksiyonel Bağımsızlık Durumuna ve Günlük Yaşam Aktivitelerine Etkisi: Randomize Kontrollü Bir Çalışma

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This study was presented as an oral presentation at 6th National 2nd International Basic Nursing Care Congress, September 15-17, 2022, İstanbul, Türkiye.

ABSTRACT Objective: This study aims to investigate the effects of range of motion (ROM) exercises performed during the acute period on daily life activities, functional independence level, and disability in individuals who have experienced a stroke. **Material and Methods:** The study was a randomized controlled experimental research. A total of 68 patients were included in the study. ROM exercises were applied for each joint for a total of seven days, five times a day for the experimental group and twice a day for the control group. Data were collected using the Functional Independence Measure (FIM), the modified Rankin Scale (mRS), and the Barthel Index (BI). In the data analysis, chi-squared, Kruskal-Wallis, Wilcoxon signed-rank test, and Mann-Whitney U test were used. **Results:** It was determined that the mean age of the patients was 69.32±11.73 years, the duration after stroke was 8.42±10.69 days, and the body mass index was 26.55±3.35 (kg/m²). It was determined that there was no significant difference between the experimental and control groups in terms of the mean BI, mRS, and FIM scores of the patients measured before and after ROM exercises. **Conclusion:** The results of the study revealed that ROM exercises had a positive impact on the level of independence, activities of daily living, and disability status in acute stroke patients. However, increasing the frequency of exercise practice did not show any difference.

Keywords: Activities of daily living; stroke; range of motion exercises

ÖZET Amaç: Bu çalışmanın amacı, inme geçirmiş bireylerde akut dönemde yapılan eklem hareket açıklığı (EHA) egzersizlerinin bireyin günlük yaşam aktivitelerine, fonksiyonel bağımsızlık düzeyine ve engellilik durumuna etkisini incelemektir. **Gereç ve Yöntemler:** Çalışma randomize kontrollü deneysel bir araştırmadır. Çalışmaya toplam 68 hasta dâhil edilmiştir. EHA egzersizleri deney grubuna günde 5 kez, kontrol grubuna ise günde 2 kez olmak üzere toplam 7 gün boyunca her bir eklem için uygulandı. Araştırma verileri, Fonksiyonel Bağımsızlık Ölçeği (FBÖ), modifiye Rankin Ölçeği (mRÖ) ve Barthel İndeksi (Bİ) kullanılarak toplandı. Verilerin analizinde ki-kare testi, Kruskal-Wallis testi, Wilcoxon işaretli sıra testi ve Mann-Whitney U testi kullanıldı. **Bulgular:** Hastaların yaş ortalamaları 69,32±11,73 yıl, inme sonrası geçen süre 8,42±10,69 gün ve beden kitle indeksi 26,55±3,35 (kg/m²) olarak belirlendi. Hastaların ROM egzersizleri öncesi ve sonrasında ölçülen Bİ, mRÖ ve FBÖ puan ortalamaları açısından gruplar arasında anlamlı bir fark olmadığı belirlendi. **Sonuç:** Araştırma sonucunda, EHA egzersizlerinin akut inme hastalarının bağımsızlık düzeyi, günlük yaşam aktiviteleri ve engellilik durumu üzerinde olumlu bir etkiye sahip olduğu görüldü. Bununla birlikte, egzersiz uygulama sıklığının artırılmasının herhangi bir farklılık göstermediği saptandı.

Anahtar Kelimeler: Günlük yaşam aktiviteleri; inme; eklem hareket açıklığı egzersizleri

Stroke is an important health problem that prevents individuals from performing activities of daily living (ADL).[1] Stroke symptoms vary based on the affected parts of the brain, but in general, sudden weakness or numbness on one side of the body, dizziness, lightheadedness, headache, sudden falls, tem-

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porary loss of vision in the eyes, aphasia or dysarthria, confusion, and motor impairment reducing the quality of life in most patients are observed.[2,3] Acute stroke is typically characterized as a sudden onset of focal neurological dysfunction that persists for a duration exceeding 24 hours.[4] The acute period of stroke is defined as the first two weeks.[5] In the acute phase after a stroke, many negative situations can occur such as postural disorder, decreased physical activity because of the motor and sensory losses in the lower extremities, and the risk of falling. The motor impairment caused by stroke causes joint immobilization, muscle atrophy, loss of joint and cartilage, and induction of the increase of connective tissue in the joint and a decrease in the passive range of motion of joints the formation of contractures in the joint. When restriction of joint movements and contractures occur, the individuals cannot perform ADLs and they lose their independence.[6]

Although stroke is a difficult process for individuals to cope with and accept, regaining lost functions, struggling with a disability, and making efforts to adapt to change help the individual to perform ADLs independently and eliminate the disability.[7] Although the aim is to prevent infarction and to minimize permanent brain damage in the first hours after the start of the stroke, it is also important to start exercises in the early period and provide high-quality care in order to combat disability and achieve the best life functions of the individuals.[8] The inability to perform ADLs after stroke; and the deterioration of joint flexibility and patency affect patients psychologically and physiologically and the clinical patient outcomes are negatively affected.[9] Range of motion (ROM) exercises are one of the important and effective nursing practices which contribute to increasing muscle tone and mass, providing and maintaining joint range in patients with a movement disorder and limitation, providing the patient's ADLs and increasing independence.[10,11] In addition, special equipment and patient awareness are not required for applying ROM exercises.[8] In the literature, it has been reported that early initiation of exercises in the post-stroke period provides better functional responses at discharge, shorter hospital stays, and improvement of motor functions.[12,13] In addition, ROM exercises in the early post-stroke period lead to changes in the sensory and motor cortex and improve motor functions, and prevents extremity deformities, and joint contractures.[12,14]

Many of the studies on the subject have reported that ROM exercises have positive effects on the physical and psychological health of stroke patients and improve motor functions, however, it is observed that there is a limited number of studies studying the effect on the patient's ADL and independence level.[8,9,12] The results of the research are important in terms of having knowledge about the effect of ROM exercises on the ADL and independence level during and after stroke, and for clinicians, in terms of knowing and applying evidence-based nursing practices.

AIM

This study aims to investigate the effects of ROM exercises performed during the acute period on daily life activities, functional independence level, and disability in individuals who have experienced a stroke.

MATERIAL AND METHODS

DESIGN

This experimental study was carried out in January-July 2021 using a randomized pretest and posttest control design.

SAMPLE

The study sample included individuals with stroke who were hospitalized in the neurology unit in a training and research hospital in the north of Türkiye. The principles of the Declaration of Helsinki were followed at all stages of the study. Ethics committee permission (date: March 06, 2020, no: 05.03.2020/03) was obtained from the Giresun University Interventional Ethics Committee for the implementation of the research, and institutional permission was obtained from the institution where the research would be conducted. "The sample size was determined using G*Power (version 3.1.9.2, Heinrich-Heine University of Dusseldorf, Germany) software". Based on Cohen's effect size coefficients, an estimated sample size of 34 participants per group was calculated, considering a Type 1 error probability of 0.05 and 80% power for bivariate tests.

The study randomly divided patients into two groups using a computer program.[15] For randomization, two-group columns between 1-68 were created using the Generate Numbers method from the randomizer.org site. Envelopes with numbers were presented to the patients using the closed envelope method, and it was randomly determined which group they belonged to (in a 1:1 ratio). Patients in group 1 (control group) underwent ROM exercise twice a day, 5 times for each joint on the affected side. Patients in group 2 (experimental group) were given ROM exercise 5 times a day, 5 times for each joint on the affected side. The patients were blinded for group assignment.

The patients who were diagnosed with a stroke; were medically stable, had speech comprehension and ability to speak, had no peripheral nerve injury before the stroke, did not have a stroke before, had a stroke onset less than one week ago, had no bilateral hemiplegia, had no neurological or orthopedic disease that impairs their arm and leg functions before the stroke, had no clinical contraindications to exercise, and applied ROM exercises completely were included in the study. The patients with impaired skin integrity, open wounds, an intervention limiting joint movement, and those who didn't accept to participate in the study were excluded from the study.

The patients and their relatives who had a stroke and met the sampling criteria were interviewed and informed about the study and asked if they wanted to participate in the study. Their verbal and written consent was obtained, and the information about the patients was obtained by direct observation of the patients, from the patient's file, and, if necessary, with the interviews with the patient and relatives of the patients. Descriptive information about the patients (age, gender, cause of stroke, the time elapsed after stroke, etc.) was obtained from the patients and relatives of the patients who accepted to participate in the study using the Patient Identification Form (PIF). Modified Rankin Scale (mRS) to determine the degree of disability and dependence, the Barthel Index (BI) to assess the ADL, and the Functional Independence Measure (FIM) to measure the level of functional independence were applied before and after the application of ROM exercise for both the application and control groups.

ROMs applied for individuals with a stroke are exercises performed in the sagittal plane (flexion, extension, etc.) and passively to increase feasibility and efficiency, and reduce the application load. In the control group, consisting of 34 patients, the researcher nurse administered ROM exercises to the affected joints on the affected side twice a day for a week, performing five repetitions for each joint. In the experimental group, also comprising 34 patients, ROM exercises were conducted five times a day for a week, with five repetitions for each joint. The ROM exercises targeted four arm joints (fingers, wrist, elbow, and shoulder) on the side affected by the stroke, as well as the four leg joints (toes, ankle, knee, hip) on the affected side. ROM exercises were performed from head to toe for all patients and performed by the same researcher nurse. ROM exercises were performed after standing on the side of the stroke and removing the bed rails and taking safety precautions, to ensure patient safety and prevent falls and injuries. The exercises were performed rhythmically and regularly, and in case of any difficulty, the joint movement was not forced and the movements were performed by supporting the joint from the bottom. The exercises were stopped when the patients expressed verbal or nonverbal pain or did not want to continue. The exercises were performed when the patients were awake in order not to disturb the patient's sleep patterns. ROM exercises were performed as follows: Shoulder: flexion-extension-hyperextension, abduction, adduction, internal and external rotation. Elbow; flexion and extension, forearm supination and pronation. Wrist; flexion, extension, ulnar and radial deviation, and movements of the fingers (flexion, extension, abduction, adduction). Hip and knee; abduction, adduction, flexion and extension, hyperextension, internal and external rotation. Ankle; inversion, eversion, dorsiflexion, plantar flexion, and finger movements (abduction, adduction, flexion, extension).[16,17]

DATA COLLECTION TOOLS

The data for the study were collected using the PIF, FIM, mRS, and BI.

PIF: This form, developed by the researcher in line with the relevant literature, is a form prepared by examining the relevant literature information such as the patient's age, gender, stroke duration, stroke etiology, the side of the stroke, location, and time orientation.[9,12]

FIM: "It is a scale assessing 18 activities including self-care, movement, transfer, sphincter control, communication, and social perception. Each activity is assessed in terms of functional independence using a 7-point scale". The total FIM score ranges from 18 to 126 (dependent in all domains/independent in all domains). As the score of the individuals increases, their independence level also increases.[18]

mRS: It categorizes post-stroke disability in six levels scored from 0 to 5. If there is no finding, it is scored as "0" and severe disability or bed dependency is scored as "5". An mRS score of two or less was defined as good final status, and an mRS score above two was defined as bad final status.[19]

BI: It is a scale developed by Mahoney and Barthel in 1965 to assess physical independence in activities of daily life and consists of 10 items (transfer, ambulation/wheelchair use, climbing stairs, dressing, feeding, self-regulation, toilet use, bathing, urinary incontinence, stool incontinence). The total score is calculated by scoring each item separately with a three-step scoring system (between 0-15 points with 5-point increases according to the question). The total score ranges from 0 to 100, and 00-20 indicates complete dependence, 21-60 indicates severe dependence, 61-90 indicates moderate dependence, 91-99 indicates mild dependence, and 100 indicates complete independence.[20]

DATA ANALYSIS

Data analysis was performed using SPSS 25.0 statistical software (IBM, Chicago, Illinois, USA). The chi-square test was employed for categorical variables in group comparisons, while the independent samples t-test was utilized for normally distributed continuous variables. For non-normally distributed continuous variables, the Mann-Whitney U test and Kruskal-Wallis analysis were employed. The Wilcoxon Signed Rank test was conducted for intra-group comparisons. A significance level of $p<0.05$ was considered statistically significant.

RESULTS

It was determined that the mean age of the patients was 69.32±11.73 years, the duration after stroke was 8.42±10.69 days, and the body mass index (BMI) was 26.55±3.35 (kg/m²). Also, it was determined that 86.8% of patients had an ischemic stroke, 52.9% of them were affected by a stroke which was on the left side of their bodies, 79.4% of them were fed orally, 52.9% of the patients had mild aphasia, 94.1% had place orientation, and the time orientation wasn't im-

TABLE 1: The distribution of clinical and descriptive features of patients (n=68).

Characteristics	X̄±SD	Minimum-Maximum
Age (years)	69.32±11.73	40-87
Duration since stroke (days)	8.42±10.69	1-48
BMI (kg/m²)	26.55±3.35	17.96-35.16
	n	%
Gender		
Female	34	50
Male	34	50
Work		
Working	9	13.2
Not working	59	86.8
Stroke		
Ischemic	59	86.8
Hemorragic	9	13.2
Side		
Right	32	47.1
Left	36	52.9
Nutrition		
Oral	54	79.4
Enteral	1	1.5
Parenteral	8	11.8
Enteral+Parenteral	5	7.4
Speaking		
Normal	27	39.7
Mild aphasia	36	52.9
Severe aphasia	5	7.4
Location orientation		
Yes	64	94.1
No	4	5.9
Time orientation		
Yes	63	92.6
No	5	7.4

BMI: Body mass index; SD: Standard deviation.

TABLE 2: Clinical characteristics of acute stroke patients in the control and experimental groups (n=68).

Variable	Control group (n=34)	Experimental group (n=34)	p value
Age (years) (X̄±SD)	69.35±11.23	69.29±12.38	0.81
Duration since stroke (days) (X̄±SD)	8.10±8.84	8.75±12.39	0.33
BMI (kg/m²) (X̄±SD)	25.52±5.54	26.84±3.27	0.49
Gender n (%)			
Female	15 (44.1)	19 (55.9)	0.33
Male	19 (55.9)	15 (44.1)	
Stroke n (%)			
Ischemic	32 (94.1)	27 (79.4)	0.07
Hemorragic	2 (5.9)	7 (20.6)	
Side n (%)			
Right	18 (56.3)	14 (41.2)	0.33
Left	16 (47.1)	20 (58.8)	
Speaking n (%)			
Normal	11 (32.4)	16 (47.1)	0.34
Mild aphasia	21 (61.8)	15 (44.1)	
Severe aphasia	2 (5.9)	3 (8.8)	
Location orientation n (%)			
Yes	31 (91.2)	33 (97.1)	0.61
No	3 (8.8)	1 (2.9)	
Time orientation n (%)			
Yes	31 (91.2)	32 (94.1)	1.00
No	3 (8.8)	2 (5.9)	

BMI: Body mass index; p<0.05 level of significance; SD: Standard deviation.

paired in 92.6% of them (Table 1). It was determined that there was no significant difference bet-ween the patients in the experimental and control groups in terms of age, gender, BMI, duration of a stroke, type of stroke, region of stroke, nutritional status, speech status, place, and time orientation (Table 2).

After the ROM exercise, the mean BI total score of the patients was 90.79±28.39 in the control group, 86.70±30.98 in the experimental group, the mean mRS total score was 2.29±1.16 in the control group, 2.23±1.25 in the experimental group, the FIM total mean score was 61.76±30.07 in the control group, and 59.55±31.14 in the experimental group. It was determined that there was no statistically significant difference between the experimental and control groups in terms of the mean BI, mRS, and FIM total scores of the patients before and after ROM exercises (Table 3). When we consider the in-group comparisons of the patients, it was determined that there was a statistically significant difference in terms of BI, mRS, and FIM total mean scores before and after the ROM exercises both in the experimental group and the control group (Table 3).

TABLE 3: Evaluation of the BI, MRs and FIM scores of the experimental and control groups (n=68).

	Control group (n=34) X̄±SD	Experimental group (n=34) X̄±SD	U-test /p value
FIM-pretest	56.47±24.90	54.26±29.90	-0.019/0.98
FIM-posttest	61.76±30.07	59.55±31.14	-0.123/0.90
Test/p	-4.875/**0.00***	-5.019/**0.00***	
mRS-pretest	2.44±1.07	2.64±1.25	-0.675/0.50
mRS-posttest	2.29±1.16	2.23±1.25	-0.274/0.78
Test/p	-2.236/**0.02***	-3.742/**0.00***	
BI-pretest	83.41±26.96	80.02±29.05	-0.239/0.81
BI-posttest	90.79±28.39	86.70±30.98	-0.172/0.86
Test/p	-3.359/**0.00***	-4.131/**0.00***	

*p<0.05 level of significance; BI: Barthel Index; mRS: Modified Rankin Scale; FIM: Functional Independence Measure; SD: Standard deviation.

Table 4 presents the results indicating that there was no statistically significant difference in the mean scores of daily life activities between the experimen-

TABLE 4: Comparison of ADL scores between experimental and control groups (n=68).

ADL	Control group (n=34) X̄±SD	Experimental group (n=34) X̄±SD	U-test/p value
Feeding	6.47±2.89	6.61±3.83	-0.48/0.62
Washing	0.73±1.79	1.17±2.15	-0.91/0.35
Self care	1.02±2.05	1.32±2.23	-0.56/0.57
Get dressed and undress	5.00±2.46	5.73±3.28	-1.10/0.27
Bowel care	5.44±2.85	4.70±3.00	-1.03/0.30
Bladder care	7.20±3.73	6.02±4.40	-1.06/0.28
Toilet use	6.76±3.66	6.32±4.13	-0.34/0.73
Mobilite	9.70±4.91	9.26±4.78	-0.47/0.63
Climbing stairs	5.00±3.25	4.26±3.04	-0.94/0.34

ADL: Activities of daily living; SD: Standard deviation.

tal and control groups. These activities include feeding, bathing, self-care, dressing, bowel and bladder care, toilet use, transfer from wheelchair to bed and vice versa, mobility status, and climbing stairs.

DISCUSSION

In this study, the effects of ROM exercises performed on patients with acute stroke on the patient's activities of daily life, level of functional independence, and disability were studied. As a result of this study, it was found that the patients in the control group had moderate dependence before and after ROM exercise, while the patients in the experimental group had severe dependence before and after ROM exercise. After the ROM exercise, the mean BI score in the control group was found to be higher compared to the experimental group, but the difference was not statistically significant. In the intra-group assessment, it was observed that there was a statistically significant difference in terms of BI total mean scores both in the experimental group and the control group before and after the ROM exercise. In accordance with the findings, we can say that the performance of ROM exercises in the early post-stroke period has a positive effect on the patient's ability to perform their daily living activities and increase their independence level, but the frequency of the exercises has no effect on the patient's activities of daily life and the level of physical independence. In the relevant studies, it has been observed that mostly the effect of ROM exercises performed for stroke patients on muscle strength has been researched, and there is a limited number of studies on the effects of ROM exercises on the patient's independence and disability levels, and their daily life activities.[9,12,21] In a study investigating the effectiveness of ROM exercises applied for each joint at least three times a week and for four weeks, the mean BI total score of the patients was found to be 67.2±5.6 before the exercise and 69.2±5.3 after the exercise.[22] It was observed that the BI score obtained before the exercises in this study was lower compared to our study, and the change in the mean total score of BI before and after the exercise was lower compared to the findings of our study. When compared with the findings in the study, Koç and Tan's study demonstrated that even though ROM exercises were applied two days a week, the total duration was longer.[22] It was determined in the study of Tseng et al., that while there was no significant difference between the mean ADL scores of ROM exercises applied twice a day for four weeks in the experimental group compared to the control group that did not receive ROM exercise, there was an increase in the ADL scores of two participants in the experimental group.[9] In accordance with the studies conducted, it is observed that the effect of the frequency of application of ROM exercises is limited, and more research is required for better observation of the effect of the exercises on the level of ADLs performance and independence in the patients for who ROM exercises are applied for a longer period of time.

There was no statistically significant difference observed between the experimental and control groups regarding the total mean scores of the mRS. However, a statistically significant difference was noted in the intragroup assessment when comparing the control and experimental groups before and after the implementation of ROM exercises. In the study, it was determined that the disability status of the patients in both groups was determined to be in good final status and the application of ROM exercises had a positive effect on the disability status, but it was determined that the frequency of application of ROM exercises did not have a positive effect on the improvement of the disability status of the patients. In a study on the relationship between risk factors and

functional independence in patients with acute stroke, the mean mRS score of the patients was found to be 4.20±1.00.[23] When compared with this research, it is seen that the patients in our group had better disability status. This result is considered to be related to the research sampling criteria.

In the study, the mean FIM total score was found to be 56.47±24.90 before the ROM exercise and 61.76±30.07 after exercise in the control group, 54.26±29.90 before the ROM exercise, and 59.55±31.14 after the ROM exercise in the experimental group. After the ROM exercise, the mean FIM total score in the control group was found to be higher compared to the experimental group, but the difference was not statistically significant. In the intra-group assessment, it was observed that there was a statistically significant difference in terms of BI total score means both in the experimental group and the control group before and after the ROM exercise in terms of mean FIM total score. This result demonstrates that the control group patients had a higher level of functional independence compared to the experimental group, but when assessed together with the mean scores before the exercise, the frequency of application of ROM exercises did not have a positive effect on the functional independence level and ADL of the patients. In other words, it can be said that when the frequency of ROM exercises is increased, there is no positive effect on the patient's ADL performance. Tseng et al., found in their study that there was no significant difference in the FIM score of ROM exercises applied on each joint five times a day for four weeks in stroke patients, but there was a significant improvement in ADL functions in 6 patients in the experimental group. In the comparison of the findings of the study of Tseng et al., and the findings of our study, it was demonstrated that longer application of ROM exercises and longer follow-up of patients may affect the level of ADLs and independence of the patients.[9] Kim et al., reported that ROM exercises applied ten times on each joint twice a day for four weeks had positive effects on ADLs.[8] In another study, it was found that the FIM score increased significantly with the program of ROM exercises and weight lifting exercises applied five days a week for two months.[24] When the results of the related studies are evaluated together, there is sufficient data to say that the ROM exercises performed in stroke patients have a positive effect on the patient's independence and the level of performing their daily life activities, however, there is not sufficient data and research finding to say that increasing the frequency and duration of the exercises has a positive effect on the independence and disability level of the patients and on the ADL performance. In the post-stroke period, motor recovery fades in the first month in the fastest manner and increases within three months, and in parallel, we can say that the effect of ROM exercises on the level of ADLs, independence, and disability can be observed more clearly when the follow-up periods of ROM exercises are observed for a longer period of time.[25]

STUDY LIMITATION

That the follow-up period of the patients was short and the long-term effects of ROM exercises on the level of independence and disability were not observed are the most important limitations of this study. In addition, the wide age range (40-87) in the study may have affected the results of the study.

CONCLUSION

As a result of this study, we can say that the ROM exercises performed in patients with acute stroke increase the ability of the patients to perform activities of daily life, have a positive effect on their functional independence levels, and reduce the disability status of the patients. On the other hand, it was observed that there was no positive effect on ADLs, functional independence status, and disability level between the application of ROM exercises five times a day and twice a day for a week.

The implementation of ROM exercises during the acute period for stroke patients can be considered a significant nursing practice that enhances patients' quality of life. This practice is particularly valuable in healthcare systems with limited resources and constrained rehabilitation programs, as ROM exercises are both accessible and cost-effective. Nurses should explain the importance of ROM exercises to patients and family members and provide training on how to do them. In addition, patients should inform their relatives about how they can support the patient to do ROM exercises safely. It is important for nurses to

monitor the effectiveness of ROM exercises and evaluate the patient's progress.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

REFERENCES

1. Norrving B, Barrick J, Davalos A, Dichgans M, Cordonnier C, Guekht A, et al. Action plan for stroke in Europe 2018-2030. Eur Stroke J. 2018;3(4):309-36. [Crossref] [PubMed] [PMC]
2. Nasb M, Li Z, S A Youssef A, Dayoub L, Chen H. Comparison of the effects of modified constraint-induced movement therapy and intensive conventional therapy with a botulinum-a toxin injection on upper limb motor function recovery in patients with stroke. Libyan J Med. 2019;14(1):1609304. [Crossref] [PubMed] [PMC]
3. Young JA, Tolentino M. Stroke evaluation and treatment. Top Stroke Rehabil. 2009;16(6):389-410. [Crossref] [PubMed]
4. Tadi P, Lui F. Acute Stroke. 2023 Aug 17. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023. [PubMed]
5. Wu P, Zeng F, Li YX, Yu BL, Qiu LH, Qin W, et al. Changes of resting cerebral activities in subacute ischemic stroke patients. Neural Regen Res. 2015;10(5):760-5. [Crossref] [PubMed] [PMC]
6. Normann B, Arntzen EC, Sivertsen M. Comprehensive core stability intervention and coordination of care in acute and subacute stroke rehabilitation. European Journal of Physiotherapy. 2019;21(4):187-96. [Crossref]
7. Chimatiro GL, Rhoda AJ. Scoping review of acute stroke care management and rehabilitation in low and middle-income countries. BMC Health Serv Res. 2019;19(1):789. [Crossref] [PubMed] [PMC]
8. Kim HJ, Lee Y, Sohng KY. Effects of bilateral passive range of motion exercise on the function of upper extremities and activities of daily living in patients with acute stroke. J Phys Ther Sci. 2014;26(1):149-56. [Crossref] [PubMed] [PMC]
9. Tseng CN, Chen CC, Wu SC, Lin LC. Effects of a range-of-motion exercise programme. J Adv Nurs. 2007;57(2):181-91. [Crossref] [PubMed]
10. Huang YC, Chuang CY, Leong CP, Wang L, Chen HL, Chiang CW. Effect of comprehensive postural instructions and range of motion exercises via educational videos on motor function and shoulder injury in stroke patients with hemiplegia: a preliminary study. J Manipulative Physiol Ther. 2018;41(8):665-71. [Crossref] [PubMed]
11. Sjattar EL, Megawati I, Irvan AM, Majid S. Development of supportive-educative range of motion exercise for post stroke patients. Home Health Care Management & Practice. 2022;34(2):92-100. [Crossref]
12. Hosseini ZS, Peyrovi H, Gohari M. The effect of early passive range of motion exercise on motor function of people with stroke: a randomized controlled trial. J Caring Sci. 2019;8(1):39-44. [Crossref] [PubMed] [PMC]
13. Maulden SA, Gassaway J, Horn SD, Smout RJ, DeJong G. Timing of initiation of rehabilitation after stroke. Arch Phys Med Rehabil. 2005;86(12 Suppl 2):S34-S40. [Crossref] [PubMed]
14. Schindler-Ivens S, Desimone D, Grubich S, Kelley C, Sanghvi N, Brown DA. Lower extremity passive range of motion in community-ambulating stroke survivors. J Neurol Phys Ther. 2008;32(1):21-31. [Crossref] [PubMed] [PMC]
15. Research randomizer (Version 3.0) [Internet]. Copyright © 1997-2023 by Geoffrey C. Urbaniak and Scott Plous [Cited: February 01, 2020]. Available from: [Link]
16. Fischer M, Fischer HC, Pritchard CJ, Watters K, Kopka K. Upper Body: Range of Motion Exercises for the Arms-Passive. Shirley Ryan Ability Lab. 2017. Cited: March 1, 2020. Available from: [Link]
17. Health Information Translations. Active Range of Motion Exercises: Wrists, Elbows, Forearms, and Shoulders. Cited: July 1, 2022. Available from: [Link]
18. Küçükdeveci AA, Yavuzer G, Elhan AH, Sonel B, Tennant A. Adaptation of the functional independence measure for use in Turkey. Clin Rehabil. 2001;15(3):311-9. [Crossref] [PubMed]
19. Zhao H, Collier JM, Quah DM, Purvis T, Bernhardt J. The modified Rankin Scale in acute stroke has good inter-rater-reliability but questionable validity. Cerebrovasc Dis. 2010;29(2):188-93. [Crossref] [PubMed]
20. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. Md State Med J. 1965;14:61-5. [Crossref] [PubMed]
21. Srinayanti Y, Widianti W, Andriani D, Firdaus FA, Setiawan H. Range of motion exercise to improve muscle strength among stroke patients. International Journal of Nursing and Health Services. 2021;4(3):332-43. [Crossref]
22. Koç A, Tan M. Assessing the efficiency of exercises intervention after ischemic stroke on activities of daily living. HealthMED. 2012;6(5):1590-9. [Link]
23. Göksel Karatepe A, Kaya T, Şen N, Günaydın R, Gedizlioğlu M. İnmeli hastalarda risk faktörleri ve fonksiyonel bağımsızlık ile ilişkisi [The risk factors in patients with stroke and relations with functional independence]. Turkish Journal Physical Medicine and Rehabilitation. 2007;53(3):89-93. [Link]
24. Manzoor S, Afzal F, Gulraiz, Qurratulain, Khalid M, Nadeem S, et al. Effects of joints weight bearing exercises combine with range of motion exercises on affected limbs in patents with stroke. International Journal of Physical Medicine and Rehabilitation. 2017;5(3):1-3. [Crossref]
25. Stinear CM, Byblow WD. Predicting and accelerating motor recovery after stroke. Curr Opin Neurol. 2014;27(6):624-30. [Crossref] [PubMed]