The effect of Proprioceptive Neuromuscular Facilitation on Quality of Life of patient with stroke

[1]Mohsen Avazpour, [2]Afroughi Solaiman, [3]Haghgoo Amin, [4]Martoob Fatemeh, [5]Parandvar Yaghoub

ABSTRACT--Regarding the importance of nursing and rehabilitation measures on reduction of complications in patients with stroke, the present study was done to examine the effect of Proprioceptive Neuromuscular Facilitation (PNF) exercise on Quality of Life (QOL) in stroke patients. This clinical trial study was performed on 60 patients with stroke referred to martyr Beheshti Hospital of Yasuj in 2018, Iran, Which lasted 4 months to 2 years from their illness. These patients were selected by random sampling, then assigned to two groups of 30 as control and intervention. The data collection tool was a shortened World Health Organization Quality of Life (WHO. QOL. Brief) Questionnaire. At first, quality of life was measured in both groups. Then, the intervention group received Proprioceptive Neuromuscular Facilitation exercise for 8 weeks. Immediately and 4 weeks after the last session of the exercise, the quality of life of the patients was measured. Then, the collected data were analyzed using Kolmogorov-Smirnov statistical tests, repeated measure ANOVA and Post-Hoc and SPSS software. The findings of this study showed that there was no significant difference in the parameters of quality of life in stroke patients before the intervention between the two groups (P>0.05), but immediately and one month after the intervention, a significant statistical difference was reported between the two groups based on Repeated Measurement Anova Test (P <0.05). According to the findings of this study, it can be concluded that Proprioceptive Neuromuscular Facilitation exercise has been able to improve the quality of life of patients with cerebrovascular accident

Keywords-- Proprioceptive Neuromuscular Facilitation (PNF), Quality of Life (QOL), Cerebrovascular Accident (CVA) or stroke

I.   INTRODUCTION

Stroke is an important incident in patients' lives, which, while causing functional disorders, causes many mental, social and economic problems for them (1). This illness, has been allocated the second cause of inability (2) and the third cause of death in the world (3). In the United States, 500,000 people get stroke annually which 160,000

1 Assistant Professor of Emergency Medicine, School of Medicine, Clinical Research Development Unit   Beheshti Hospital, Yasuj University of Medical Sciences, Yasuj. Iran

2 Assistant Professor of Biostatistics, Faculty member of School of Health and Nutrition Sciences, Yasuj   University of Medical Sciences, Yasuj, Iran

3 MSc of Psychiatric Nursing, School of Nursing and Midwifery, Yasuj University of Medical Sciences, Yasuj,   Iran

4 MSc, Department of Nursing, Behbahan Branch, Islamic Azad University, Behbahan, Iran

5 MSc of Medical Surgical Nursing, Social Determinants of Health Research Center, Yasuj University of Medical Sciences, Yasuj, Iran, y.parandvar@gmail.com,+98917343176

of them lose their lives (4). According to studies, in Asia, the number of deaths due to Stroke is the same as deaths from cardiovascular disease (5). Also, the rate of stroke in Iran is reported from 23 to 103 per 100,000 people (6). This disease has a devastating effect on the lives of patients, which causes changes in their lifestyle and ultimately affects the quality of life of patients (7). Quality of life is a multidimensional concept that encompasses various physical, psychological, social and personal aspects. The World Health Organization defines the quality of life of an individual's understanding of life, values, goals, standards and preferences. In other words, Quality of life means the extent of the gap between one's wishes and desires and what one feels and realizes(8). Non-use of organs resulting from motor disorder is due to factors such as muscle weakness, muscle stiffness and reduced motor skills which leading to muscle atrophy (9). The motor disabilities that occur after a stroke can disrupt the activities of daily living of these patients (10) which this disability is the cause of poor quality of life after the disorder (11). However, with continuous rehabilitation, improvement in functional status is possible (12) and helps to improve their quality of life (13). Several studies confirm the decline in quality of life after a stroke (14, 15). To treat patients with stroke, drug therapy is used to prevent it (16) but there is no definitive treatment for these cases and the only treatment to improve and increase functional autonomy is prevention and rehabilitation (17, 18).

Therefore, the goal of treating patients with stroke is to improve the quality of life by reducing the effects of the disease (19). One of the most important responsibilities of nurses is their vital role in patient education, rehabilitation, and patient transformation into an autonomous and self-sufficient person (20). It seems that the use of an effective way to improve neuromuscular function can lead to improved quality of life and lower medical-social costs. It is likely that the PNF technique is one of these methods. Proprioceptive Neuromuscular Facilitation exercise is a technique for developing motor ability (21).

The technique of Proprioceptive Neuromuscular Facilitation was first developed by Kabat and Knott in 1940 for the treatment of neurological dysfunction (22). This exercise is a technique aimed at developing motor ability (23). These exercises include several patterns of movement that facilitate and correct the motor command of the brain by receiving deep sense signals within the muscles. Therefore, correction of the defective pattern can lead to order and facilitate the transfer of deep sense and correction of joints and muscles status (24). The main goal in this technique is to improve performance (increase flexibility and improve muscle strength) (25). The effect of these exercises on increasing muscle flexibility is on neurological and physiological mechanisms including reflex muscle tension. This mechanism increases the amount of traction tolerance (26, 27). Proprioceptive Neuromuscular Facilitation exercises reduce spasms in patients, thereby increasing muscle strength and reducing fatigue (28). Exercise training increases muscle strength, which may be due to changes in the communication between motor neurons. These changes lead to more synchronization and recall of motor units, which improves the amount of power produced and the capacity to sustain the force (29). Knott et al. (2011) found that deep muscle neuromuscular facilitation techniques could be used as a novel method for use in motor exercises (21). In a clinical trial study entitled "The effect of Proprioceptive Neuromuscular Facilitation technique on motor function of stroke patients" by Akosil et al. (2011), the use of PNF technique as an effective treatment for motor function in the rehabilitation of patients with stroke was emphasized (30).

Therefore, considering the precautions about different dimensions of stroke and its impact on the individual and social performance of these patients, finding methods that can improve the quality of life of these people can be helpful in reducing the various consequences of the disease. But, since various studies have presented contradictory results in this regard, this study was done to examine the effect of Proprioceptive Neuromuscular Facilitation (PNF) exercise on Quality of Life (QOL) of stroke patients admitted to the martyr Beheshti hospital of Yasuj.

II.   ANALYSIS METHOD:

This clinical trial was performed in two groups of control and intervention, before, immediately and one month after the intervention on 60 patients with stroke who had a history of hospitalization in neurology ward of Martyr Beheshti hospital of Yasuj in 2018.

III.   SAMPLING METHOD:

Initially, samples were selected as non-probable and available. Then, in a randomized block assignment, assigned to two groups of 30 intervention (14 female and 16 male) and control (12 women and 18 male).

IV.   INCLUSION CRITERIA:

Personal and informed consent to attend the study, Over 4 months to 2 years after stroke, Age more than 60 years to 90 years, Once having a stroke, Non-active phase of the disease, Lack of orthopedic and neurologic diseases, Ability to communicate and Muscle Strength was less than 3.

V.   EXCLUSION CRITERIA:

Unwillingness or inability to continue participation during study, exacerbation of disease or recurrent stroke, need for hospitalization, occurrence of other illnesses, need for simultaneous physiotherapy, failure to participate in more than 2 sessions, Impairment of the patient's cognitive, conscious and mental status, and cognitive deficits during study and death.

VI.   DATA COLLECTION TOOLS

Data collection tools included demographic checklists (including age, sex, marital status, education level, former occupation, residence status, family history, duration of illness, duration of drug therapy, brain damaged hemisphere and half paralyzed) and the World Health Organization Short Form Quality of Life Questionnaire(WHO. QOL. Brief).The questionnaire contains 26 questions that measures the person's overall and general quality of life, including 4 sub-scales (physical, psychological, social and environmental) and an overall score. At first, a raw score is obtained for each sub-scale, which must be converted to a standard score between 0 and 100 through a formula. A higher score indicates a higher quality of life. To assess the validity and reliability of this questionnaire, a study was done on 1167 people in Tehran. Participants were divided into two groups: chronic and non-chronic. Reliability of test-retest for sub-scales was as follows: physical health 0.77, mental health 0.77, social relations 0.75, and environmental health 0.84. The reliability of thewhole questionnaire was reported to be 0.78 by Cornbrash's alpha (31). Proprioceptive Neuromuscular Facilitation exercise was performed in intervention group for 8 weeks and two sessions per week for 30-45 minutes (16 sessions in 2 months) according to protocol and guidelines but in control group no action was taken (30). Since the researcher had to do the exercises at the patients' home, the time for the exercises was to be agreed upon with the patients during the day.

The following two models were used in this study:

1-Arm joint patterns (Upper   limb):

Flexion-Abduction-External rotation (Elbow flexed and Elbow extended)

Extension-Adduction-Internal rotation (Elbow flexed and Elbow extended)

Flexion-Adduction- Internal rotation (Elbow flexed and Elbow extended)

Extension-Abduction- External rotation (Elbow flexed and Elbow extended)

2. Knee joint patterns (lower limb):

Flexion-Abduction-External rotation (Knee flexed and   Knee   extended)

Extension-Adduction-Internal rotation (Knee flexed and Knee extended)

Flexion-Adduction-Internal rotation (Knee flexed and Knee extended)

Extension-Abduction-External rotation (Knee flexed and Knee extended)

The therapist first placed the member in a balanced position and the muscle was pulled as far as possible. The exercises two times a week for 30 to 45 minutes lasted for 8 weeks (30, 32). The exercises are as follows:

First step: An inactive or active stretch was applied within 10 to 20 seconds and the muscle or target muscles were gently moved to the end of the range.

Second stage: Immediately, or after a rest of about 2 to 3 seconds, the contraction take place unlike the resistance of the therapist. The duration of this contraction is typically 3 to 6 seconds. At this stage, the target muscle is calmed down by the "self-restraint" or "reverse tensile reflection" mechanism and is prepared for further elongation.

The third stage: Immediately, or after an interval of about 2 to 3 seconds, the muscle or target muscle again stretched to reach a new point in the range of motion (23).

Immediately and 4 weeks after the last exercise session, the quality of life of the patients was measured in both intervention and control groups by using relevant questionnaire (31).

VII.   STATISTICAL ANALYSIS

The collected data were analyzed by SPSS software using descriptive statistics(Tables and charts, indicators centrist and dispersion indicators) as well as inferential statistical tests (Kolmogorov Smirnov Z Test, Repeated Measurement ANOVA and Post-Hoc Test) with 95% confidence level and $P<0.05$.

VIII.   RESULTS

The results of this study showed that the research samples were in groups 60 to 90 years old in both groups. Most of the samples were male (56.7%). Most of the samples (35%) were unemployed. 40% of the samples had elementary education, 36.7% had illiterate, and the remainder had middle and high school education. 20% of the intervention group and 30% of the control group were rural. 30% of the intervention group and 23.3% of the control group were single and the remainder were married, divorced and separated**.** In both control and intervention groups, 55% had a positive family history of stroke. 61.7% of the samples had stroke in the right hemisphere and 38.3% in the left side. 61.7% of the samples were paralyzed in the left half of the body and 38.3% in the right half.

The results of one-way ANOVA before intervention showed no significant difference between the mean total score of quality of life in the intervention and control groups ($p = 0.005$). The results of ANOVA test in this study showed that the mean score of physical health achieved by the intervention group immediately after the intervention and also one month after the intervention was significantly higher than the control group ($P = 0.001$). The mean score of mental health was significantly higher in the intervention group immediately after the intervention and also one

month after the intervention. Below the scale of social health (p = 0.04) and environmental health (p = 0.008) the results showed that, Immediately after the intervention and one month after the intervention, the mean score obtained by the intervention group was significantly higher than the control group (p = 0.005). From the overall score obtained by the two intervention and control groups, the results showed that, Immediately after the intervention and one month after the intervention, the mean score obtained by the intervention group was significantly higher than the control group (p = 0.001), (Table 1).

The intra-group comparison of the mean scores obtained by the intervention group in the four sections of physical, mental, social and environmental, as well as the total score obtained between the three different time intervals showed that, there was a statistically significant difference between pre-intervention and immediately after intervention, before intervention with one month after intervention and also immediately after intervention with one month after intervention (P = 0.001). Also, simultaneous comparison of the mean ratings obtained in these five sections showed that there was a statistically significant difference between the mean ratings obtained in the three time periods studied (P = 0.001). This statistically significant difference means that interventions in all four sections related to quality of life were effective (Table 2).

The intra-group comparison of the mean scores obtained by the intervention group in the four sections of physical, mental, social and environmental, as well as the total score obtained between the three different time intervals showed that, there was no statistically significant difference between any of the time intervals. Also, simultaneous comparison of the mean ratings obtained in these five sections showed that there was no statistically significant difference between the mean ratings obtained in these three time periods (P≥0.05) (Table 3).

Table 1: compare the Quality of Life scores before and after intervention in both experimental and control group

QOL	Parameter	time	Intervention	Control	Statistical test	
			M±SD	M±SD	Statistics(t)	P-value
	Physical health	Before intervention	34.8±20.6	49.3±17.4	-3.5	0.2
		Immediately after the end of the intervention	45.8±16.8	46±15.6	-.03	0.001
		One month after the end of the intervention	50±14.9	43.4±16.9	1.6	0.001
	Mental health	Before intervention	34.2±18.2	47.4±15.7	-.3	0.4
		Immediately after the end of the intervention	47.5±14.8	44.4±13.4	-.8	0.02
		One month after the end of the intervention	53±12.3	43.7±13.4	-2.8	0.007
	Social health	Before intervention	34.2±14.4	55.3±14.8	-5.6	0.5
		Immediately after the end of the intervention	47.5±13.3	47.2±15.2	-.07	0.04
		One month after the end of the intervention	55±14.3	46.4±14.1	-2.3	0.02
		Before intervention	40±8.8	52.4±11.3	-4.7	0.5

Environmental health	Immediately after the end of the intervention	49.8±10.4	48.6±11.4	-.4	0.008
	One month after the end of the intervention	53.5±11.4	49±10.8	-1.6	0.005
Total score	Before intervention	35.8±14.7	54.6±20.9	-3.4	0.5
	Immediately after the end of the intervention	54.6±18.7	51.2±20.3	-.6	0.001
	One month after the end of the intervention	65±15.5	49.1±19.7	-3.4	0.001

One-way ANOVA repeated measures test

Table 2 : compare the Mean Difference and Mean Rank in Quality of Life before and after the intervention in experimental group

QOL Parameter	Mean difference						Mean rank			
	T2 - T1		T3 - T1		T3 – T2		T1	T2	T3	P-value
	MD	P-value	MD	P-value	MD	P-value				
Physical health	11.4	0.0001	15.7	0.0001	4.2	0.0001	32.5	48.7	55.1	0.0001
Mental health	13.3	0.0001	18.9	0.0001	5.6	0.0001	31.3	48.2	57	0.0001
Social health	13	0.0001	20.8	0.0001	7.8	0.0001	28.9	47.6	60	0.0001
Environmental health	8.6	0.0001	13.5	0.0001	4.9	0.0001	29.6	47.9	59	0.0001
Total score	20.8	0.0001	31.2	0.0001	10.4	0.0001	24.8	49.4	62.3	0.0001

Post - Hoc test

Table 3 : compare the Mean Difference and Mean Rank in Quality of Life before and after the intervention in control group

QOL Parameter	Mean difference						Mean rank			
	T2 - T1		T3 - T1		T3 – T2		T1	T2	T3	P-value
	MD	P-value	MD	P-value	MD	P-value				
Physical health	-3.3	0.05	-5.9	0.2	-2.6	0.07	51	44.9	40.5	0.2
Mental health	-2.9	0.05	-3.6	0.07	-2.9	0.05	50.1	44	42.3	0.5
Social health	-7.8	0.1	-8.9	0.07	-1.1	0.2	55.4	41.5	39.6	0.07
Environmental health	-2.6	0.2	-3.4	0.5	-.83	0.09	49.5	44.2	42.8	0.3
Total score	-3.3	0.9	-5.4	0.04	-2.08	0.1	49.7	44.7	42.1	0.4

Post - Hoc test

IX.   DISCUSSION:

The aim of this study was done to investigate the effect of Proprioceptive Neuromuscular Facilitation exercise on Quality of Life of stroke patients. In this study it was found that the quality of life of patients with stroke has increased after Proprioceptive Neuromuscular Facilitation exercise.

In the present study, proprioceptive neuromuscular facilitation exercises were performed at home. Thus, the results of this study are in line with the study of Azimi et al. (2013). They studied the impact of home-based rehabilitation on the quality of life of brain patients, which results showed an increase in patients' quality of life after the intervention (33).

A similar study on multiple sclerosis patients by Attar Sayyah et al. (2016), entitled The Effect of 8-Week Combination Training on Fatigue and Quality of Life in Multiple Sclerosis Patients, also confirms this (29). The study by Hui-Chan et al. (2009), which was done to effect the rehabilitation program on lower limb function after a stroke, showed that these exercises improve the function of the lower limb (34). Akosile et al. (2011) evaluated the effect of Proprioceptive Neuromuscular Facilitation technique twice weekly for 8 weeks on motor function of 17 patients with stroke. The results of their study showed that the overall score of Emory motor function for all sub-functions decreased significantly after the intervention (30). According to the study by Hopman et al., Rehabilitation, especially in the physical aspect, has a positive effect on the lifestyle and quality of life of stroke patients (35).

To justify the efficacy of this home rehabilitation method, it can be said that Proprioceptive Neuromuscular Facilitation exercise with the mechanism of muscle rehabilitation can lead to greater flexibility in the muscle strength of stroke patients. As a result, the patient's physical fitness has increased and this event will improve the activities of daily living of these patients and ultimately improve their quality of life.

The results of Eghlidi and colleagues' study (2015) "The effect of motor sensory training on basic and server activities of daily living in people with chronic stroke" suggested that this intervention could be an effective intervention in rehabilitation of stroke patients (36 Proprioceptive Neuromuscular Facilitation exercises work by using unique spiral patterns to stimulate and initiate natural responses. In addition, deep stimulation of sensory organs such as the spindle and tendons causes concentric stimulation during muscle or tensile force. A study by Delectuse et al has shown that deep neuromuscular facilitation exercises are likely to improve general physical fitness and moderate motor function ability in patients (37).

X.   CONCLUSION:

According to the findings of this study, it can be concluded that the implementation of Proprioceptive Neuromuscular Facilitation exercises has an impact on the quality of life of patients with stroke and since improving the quality of life of these patients is one of the main goals of stroke control, therefore, it is recommended that members of the health team consider implementing these rehabilitation methods in the treatment program for patients with stroke to improve the health of these patients. These exercises are economically cost-effective and even workable by the patient's family members, so they can be effective in controlling the disease and reducing frequent hospital visits.

XI.   RESEARCH LIMITATIONS:

Limitations of this study include low availability of eligible samples, high patient mortality, frequent hospitalizations, lack of co-operation, relocation, time consuming, unavailability of samples due to physical problems during the study, and mental health problems. Therefore, it is recommended that the researchers consider the above in their studies.

XII.   ACKNOWLEDGEMENT:

REFERENCES:

1. Daniel K, Wolfe CD, Busch MA, McKevitt C. What are the social consequences of stroke for working-aged adults? A systematic review. Stroke. 2009;40(6): 431-40.

2. Robinson RG. The clinical neuropsychiatry of stroke: Cognitive, behavioral and emotional disorders following vascular brain injury: Cambridge University Press; 2006.

3. Smeltzer S, Bare B, Hinkle J, Cheever K. Medical Surgical Nursing. Translated:Moshtagh Z. 2011.meltzer S, Bare B. Brunner and Suddarth's Textbook of Medical Surgical Nursing. Lippincott Wilkins, 11th edition. 2008.

4. Tapas K, Shyamal K. Epidemiology of stroke in India. Neurology Asia. 2006;11:1-4.
    Ghahremani F, Dadgoo M, Noorizadeh S, Mazdeh M, Pourahmadi M. The relationship between shoulder pain with shoulder neuromusculoskeletal disorders in post stroke hemiparsis. Journal of Modern Rehabilitation Faculty of Rehabilitation of Tehran University of Medical Sciences. 2014;8(14):30-6.

5. Pan JH, Song XY, Lee SY, Kwok T. Longitudinal analysis of quality of life for stroke survivors using latent curve models. Stroke. 2008;39(10):2795-802.

6. Sainsbury A, Heatley R. Review article: psychosocial factors in the quality of life of patients with inflammatory bowel disease. Aliment Pharmacol Ther. 2005;21(5):499-508.

7. Pang M, Eng J. Muscle strength is a determinant of bone mineral content in the hemiparetic upper extremity: implications for stroke rehabilitation. Bone. 2005;37(1):103-11.

8. Khorrami Markany A, YarMohammadi A, Khalkhali H, Azimzadeh R. Assessing the effectiveness fh home nursing care plan on activieies of daily living of stroke patients in Urmia, 2014. Journal of Urmia Nursing And Midwifery Faculty. 2016;13(12):1071-80.

9. Muus I ,Petzold M, Ringsberg KC. Health-related quality of life among Danish patients 3 and 12 months after TIA or mild stroke. Scandinavian journal of caring sciences. 2010;24(2):211-8.

10. Dhamoon MS, Moon YP, Paik MC, Boden-Albala B, Rundek T, Sacco RL, et al .Long-term functional recovery after first ischemic stroke the northern manhattan study. Stroke. 2009;40(8):2805-11.

11. .Bowling A. Measuring Health: A Review of QoL Measurement Scales, 3rd edn, Maidenhead, UK. Open University Press; 2005.

12. Fattahi A ,Azad A, Montazeri A. Study of quality of life in people with stroke in Kermanshah. Novin Rehabil J. 2008;2(1):5-12.

13. Mozhdeh M, Yaghoubi A. Measuring quality of life in aphasic stroke patients referred to neurologic centers of Hamadan. Qom J Univ Med Sci. 2009;1(3):13-21.

14. Heidarzadeh M, Ghahremanian A, Hagigat A, Yoosefi E. Relationship between quality of life and social support in stroke patients. Iran Journal of Nursing. 2009;22(59):23-32.

15. avuzer G, Kucukdeveci A, Arasil T, Elhan A. Rehabilitation of stroke patients: clinical profile and functional outcome. American journal of physical medicine & rehabilitation. 2001;80(4):250-5.

16. Pang M, Harris J, Eng JJ. A community-based upper-extremity group exercise program improves motor function and performance of functional activities in chronic stroke: a randomized controlled trial. Archives of physical medicine and rehabilitation. 2006;87(1):1-9.

17. Wu X, Min L, Cong L, Jia Y, Liu C, Zhao H, et al. Sex differences in health-related quality of life among adult stroke patients in Northeastern China. Journal of Clinical Neuroscience. 2014;21(6):957-61.

18. Stuart G. Principles and practice of psychiatric nursing. Elsevier Health Sciences. 2014.

19. Soltandoost H. Duration of Maintained Hamstring Flexibility after a One-Time PNF-CRCA Stretching Protocol in Non-athlete: Tarbiat moMoallem 2011.

20. Victoria G, Carmen E.V, Alexandru S, Antonel A, Florin C & Daniel D. (2013). The PNF (Proprioceptive Neuromuscular Facilitation) Stretching Technique – a brief review. Science, Movement and Health, 13(2): 623-8.

21. Soltandoost H. C(2011). Duration of Maintained Hamstring Flexibility after a One-Time PNF-CRCA Stretching Protocol in Non-athlete. Masters Thesis, Tarbiat moMoallem .

22. Voss D.E, Ionta M.K, Myers B.J & Knott M. (1985). Propriceptive Neuromuscular Facilitation:Patterns and Techniques, newyork, NY:Harper and Row.

23. Mcatee R& Charland J. Facilitated Stretching.(1999). Champaign, Human Kinetics, 4.

24. Funk D.C, Swank A.M, Mikla B.M, Fagan T.A & Farr B.K.(2003). Impact of prior exercise on hamstring flexibility: a comparison of proprioceptive neuromuscular facilitation and static stretching. The Journal of Strength and Conditioning Research, 17(3): 489-92.

25. .Malliaropoulos N, Papalexandris S, Papalada, A & Papacostas E.(2004). The role of stretching in rehabilitation of hamstring injuries: 80 athletes follow-up. Medicine and science in sports and exercise, 36(5): 756-9.

26. Henze T, Rieckmann P & Toyka K. (2006). Symptomatic treatment of multiple sclerosis. European neurology, 56: 78-105.

27. Attar Sayyah E, Hoseini Kakhk S.A.R, Hamedinia M. R & Mehrjoo M. (2016). Effect of 8-Week Combined Training (Resistance and Proprioceptive Neuromuscular Facilitation) on Fatigue and Quality of Life in Multiple Sclerosis Patients. Quarterly of the Horizon of Medical Sciences, 22(1): 43-50.

28. Akosile C ,Adegoke B, Johnson O, Maruf F. Effects of Proprioceptive Neuromuscular Facilitation Technique on the Functional Ambulation of Stroke Survivors. Journal of The Nigeria Society Of Physiotherapy. 2011;18:22-7.

29. Yousefy A, Ghasemi G, Sarafzadegan N, Malek S, Rabie K, Baghaei A. Normalization (standardization) scale (questionnaire) World Health Organization Quality of Life Short Form in the Islamic Republic of

Iran. Deputy Minister for Research and Technology, Isfahan University of Medical Sciences & Health Services. 2010.

30. Shahla ND, Ardashir A, Yaghoub P. The Effect of Proprioceptive Neuromuscular Facilitation (PNF) on Activities of Daily Living of client with Cerebrovascular accident. Middle East Journal of Family Medicine. 2017 Sep 1;7(10):154.

31. Azimi R, Mohammadi F, Hosseini M, Farzi M. The effect of home-based stroke rehabilitation on quality of life of stroke survivors and their family caregiver's strain. Evidence Based Care. 2013;3(1):77-85.

32. Hui-Chan C, Ng S, Mak M. Effectiveness of a home-based rehabilitation programme on lower limb functions after stroke. Hong Kong medical journal= Xianggang yi xue za zhi. 2009;15(3 Suppl 4):42.

33. Hopman W & Verner J. C(2003). Quality of life during and after inpatient stroke rehabilitation. Stroke, 34: 801-5.

34. Eghlidi J, Mirshoja M.S, Shafiei Z, Jamebozorgi A & Taghizadeh G. (2015). The Effect of Sensory-Motor Training On Recovery of Basic and Instrumental Activity of Daily Living in Chronic Stroke Patients. The Scientific Journal of Rehabilitation Medicine, 4(2): 79-85.

35. Delectuse C, Roelants M & Verschueren S. (2003). Strength increase after whole-body vibration compared with resistance training. Medicine and science in sports and exercise, 35(b):1033-41.