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Role Of Repetitive Facilitation Exercises In Functional Improvement Of Upper Limb In Stroke Patients As Compare To Conventional Rehabilitation

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ABSTRACT

Key Words:
Stroke, Upper Limb,
Facilitation Technique,
Repetitive Facilitation Exercise, UCLA, Patients Satisfaction.

OBJECTIVE: To find the role ofRepetitive facilitative exercises in functional improvement of upper limb in stroke patients as compare to conventional rehabilitation.

METHODOLOGY: 26 patients fulfilling the inclusion and exclusion criteria were enrolled in this study. Outcome or efficacy was measured by using University of California-Los Angeles (UCLA) scoring system, a 35-point scale. The items measured included Pain (10 points), Function (10 points), Active forward flexion (5 points), strength of forward flexion (5 points) and patient satisfaction (5 points). A score of 34-35 is considered an excellent score, 28-33 a good result, and any score less than 27 a poor result.

RESULTS AND CONCLUSION: We found that overall pain improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05). Our investigation also led us to conclude that function of patients improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05). Moreover, similar statistics regarding active forward flexion are found i.e., overall active forward flexion and strength of forward flexion was improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05). Patient's satisfaction was improved from baseline to last follow up (p-value < 0.05). The group B had more satisfaction as compare to group A (p-value < 0.05). The group B had more UCLA score as compare to group A (p-value < 0.05). In group A efficacy of treatment was observed in 1 (7.7%) patient only while in group B the efficacy of treatment was seen in 8 (61.53%) patients. Group B had statistically and significantly higher efficacy as compare to group-A, p-value < 0.05.

INTRODUCTION

Stroke occurs when an artery to the brain is lodged. When the cut-off is brief, the stressed brain cells are reversible. But when the cut off is prolonged for more than 3 or 4 minutes, the cells can die and brain can be completely damaged. (LloydJones, Adams et al. 2010). The most common cause of death is stroke. Each year, approximately 795,000 people bear a stroke (Khealani, Hameed et al. 2008, Khan, Nazet al. 2009, LloydJones, Adams et al. 2010, Taj, Zahid et al. 2010). There are two main types of strokes are ischemic and hemorrhagic. In ischemic stroke portion of the blood vessel is lodged and cells are deprived of oxygen and glucose.

In hemorrhagic stroke blood vessels that carry nutrients and supply oxygen to the brain spills blood (Singh, Atam et al. 2013). A study demonstrated the frequency of ischemic stroke is 75% and frequency of hemorrhagic stroke is 14% of cases. (Taj, Zahid et al. 2010). In a Pakistani study 67.9% patients were diagnosed of ischemic stroke while 21.4% patients presented with hemorrhagic stroke among all stork patients (Suhail 2008). Physical therapy has a marvelous role in the rehabilitation of stroke victims. There are various kinds of different physical therapy approaches compared for their efficacy. There are several methods which are most commonly used nowadays. There is a differentiation conventional and the neurophysiological treatment approaches, the latter claiming a basis in neurophysiological principles (Dickstein, Hocherman et al. 1986). Previous studies with repetitive facilitation exercises (RFEs) show that the functional recovery of hemiplegic patients may depend on repetition of movements evoked by the repetitive facilitation exercises (RFEs) (Kawahira, Shimodozono et al. 2004, Kawahira, Noma et al. 2009).No study has been done on Pakistani population so aimed this study to conduct by taking data from Sheikh Zayed hospital and Hamza hospital Lahore. Stroke has both changeable and non-changeable risk factors, Hypertension, diabetes, hyperlipidemia, heart diseases, Obesity, excessive alcohol use, blood disorders are modifiable risk factors while advance age, male gender, previous stroke or heart attack and artery abnormalities are non-modifiable risk factors. The most important risk factors in males are hypertension 35 (59.3%) and smoking18 (94.7%), while the presence of diabetes mellitus 16 (55.2%) and in females diabetes mellitus and IHD are common.

Overweight is most common risk factor for stroke. Many studies have shown that a high body mass index (BMI) can enhance the risk of total stroke, mainly ischemic stroke (Kandel, Schwartz et al. 2000). Obesity is a serious worldwide health problem. The widespread presence of obesity has been increasing from the last 2 decades. Obembe colleagues reported the mean BMI 25.48±3.37 and 24.06±4.68 in patients with Hemorrhagic and Ischemic stroke. (Tortora and Derrickson 2008). One study found the mean BMI was 30.25 ± 2.74kg/m ^{2} and 72.9% had BMI level >25 which indicates that most of the ischemic stroke patients over weight and obese (Singh, Atam et al. 2013). The standard normal weight men as defined by a BMI of 18.5-24.9 kg/m2, the adjusted risk of ischemic stroke was 51% lower in underweight men (BMI less than 18.5), 27% more in overweight men (BMI 25.029.9), and 70% higher in obese men (BMI 30 or higher). In comparison, low weight women have an 81% greater risk of ischemic stroke than normal-weight women. Overweight women has an 11% increase in ischemic stroke, compare with normal-weight women, while obese women has a 41% increased risk.(Guttenplan 1995)

MATERIALS AND METHODS

This was a randomized control trial(RCT). This study was completed in at RCRS by taking data from Sheikh Zayed hospital and hamza hospital Lahore. It was completed in 3 months after the approval of synopsis. Non probability purposive sampling was used. We divided the selected samples into two groups. Group A: It was a control group which wills receive Conventional Rehabilitation (CR). Group B: It was the experimental group that was treated with Repetitive Facilitation Exercise (RFE) and conventional rehabilitation (CR). 26 patients were taken in this study by taking 13 cases in each group. The sample size was calculated using 80% improvement in Repetitive Facilitation Exercise group and 20% improvement in conventional rehabilitation groups. We used 95% power of study, 5% level of significance and 95% confidence level.

$$n = \frac{\left\{ z_{1-\alpha}\sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)} \right\}^2}{(P_1-P_2)^2}$$

Sample Selection Criteria in inclusion were age 35-65, both genders and patients with diabetes and hypertension. Exclusion criteria were patients having Atherosclerosis (on available medical record) and patients having atrial fibrillation (on available medical record). Performa for the data was used as study tool.

The study was conducted on 26 patients. Informed consent was taken from all the patients to include their data in research. Demographic information including name, age, and gender was noted. Outcome or efficacy was measured using the efficacy was calculated using University of California-Los Angeles (UCLA) scoring system, a 35-point scale. The items measured included Pain (10 points), Function (10 points), Active forward flexion (5 points), strength of forward flexion (5 points) and patient satisfaction (5 points). A score of 34-35 is an excellent score, 28-33 is a good result, and any score less than 27 is a poor result. Score was taken on each visit, score of 28-35 shows excellent or good result after 4 weeks that was considered as efficacy of the method.In this study**,** the control group was receiving the conventional physiotherapy which includes, shoulder wheel, stretching, icing, strengthening exercises, splinting, etc. along with range-of-motion exercises (ROM ex) for the upper limbs, activities of daily living (ADL) training including wiping, pinching and sanding movements of the hemiplegic upper limb for 40 min. The experimental group also receives the conventional physiotherapy same as control group along with repetitive facilitation exercises. The RFE session consists of stretch reflex and the skin-muscle reflex. Each repetitive exercise was given for 100 repetitions /session for 4 weeks.

The duration of the RFE session is the same as that of the CR session. The ROM exercise for the upper limb in the CR session are substituted by RFEs, which includes the full ROM of the joint of the upper limb in active or passive movements and are completed within 30 minutes, in the RFE session. Following treatment period both the outcome measure i.e., UCLA was administered to each subject of both the groups and the improvement rated. All the collected information was entered and analyzed using SPSS version (18.0). Frequency and percentage for qualitative variable and mean ± S.D was used for quantitative variable. Independent sample t-test/Mann Whitney U test was used to compare Mean UCLA score in both groups at each follow ups. Chi-square test was used to see any association between final outcome and both groups. Repeated measurement ANOVA will also be used for comparison within groups.

RESULTS

In this study the mean age of patients was 54.38 ± 8.65 years, whereas in control group and experimental group the mean age of patients was 50.69±9.25 years and 58.08 ± 6.39 years respectively.There were 14(53.85%) male and 12(46.15%) female patients in this study. In group A there were 6 males and 7 females while in group B there were 8 males and 5 female patients. In group A and B there were 11 and 9 hypertensive patients respectively. There were 8 and 9 diabetic patients in control group and in experimental group.Before treatment the mean pain in control group and experimental group was 4.15 ± 1.62 respectively while at first follow up the mean pain in group – A and group – B was 5.38 ± 1.60 and 4.77 ± 1.64 respectively. More over the mean pain at 2nd follow up in control group and experimental group was 6.62 ± 1.12 and 5.62 ± 1.98 and at 3rd follow up the mean pain in control group and experimental group was 7.77 ± 0.83 and 7.08 ± 2.1. Overall pain improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05). Before treatment the average function in control group and experimental group was 4 ± 1.29 and 4 ± 1.95 respectively while at first follow up the mean function in control group and experimental group was 4.08 ± 1.32 and 4.38 ±1.98 respectively. More over the mean function at 2nd follow up in control group and experimental group was 5.08 ± 1.553 and 5.46 ± 1.98 and at 3rd follow up the mean function in control group and experimental group was 5.85 ± 1.72 and 6.31 ± 2.17. Overall function of patients improved from baseline to last follow up (p-value < 0.05) with

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nonsignificant difference in both study groups (p-value>0.05). Before treatment the average active forward flexion in control group and experimental group was 2.23 ± 2.23 and 2.26 ± 0.72 respectively while at first follow up the mean active forward flexion in group – A and group – B was 2.69 ± 0.75 and 2.54 ± 0.66 respectively. More over the mean active forward flexion at 2nd follow up in control group and experimental group was 3.31 ± 0.63 and 3.23 ± 0.72 and at 3rd follow up the mean active forward flexion in control group and experimental group was 3.69 ± 0.63 and 3.89 ± 0.25.

Overall active forward flexion was improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05). Before treatment the average strength forward flexion incontrol group and experimental group was 2.08 ± 0.76 and 2.15 ± 0.80 respectively while at first follow up the mean strength forward flexion in control group and experimental group was 2.46 ± 0.66 and 2.69 ± 0.75 respectively. More over the mean strength forward flexion at 2nd follow up in control group and experimental group was 3.23 ± 0.59 and 3.38 ± 0.87 and at 3rd follow up the mean strength forward flexion in control group and experimental group was 3.69 ± 0.48 and 3.77 ±0.83. Overall strength forward flexion was improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05).

Before treatment the average patient's satisfaction in control group and experimental group was 4.46 ± 0.776 and 4.38 ± 1.12 respectively while at first follow up the mean patient's satisfaction in control

group and experimental group was 4.46 ±0.766 and 4.38 ± 1.12 respectively. More over the mean patient's satisfaction at 2nd follow up in control group and experimental group was 4.62 ± 0.768 and 4.69 ± 0.75 and at 3rd follow up the mean patient's satisfaction in control group and experimental group was 54.79 ± 0.451 and 4.97 ± 0.59. Overall patient's satisfaction was improved from baseline to last follow up (p-value < 0.05). Patients in experimental group had more satisfaction as compare to control group (p-value < 0.05).

Before treatment the average UCLA in control group and experimental group was 13.92 ± 4.3 and 12.62 ± 4.46 respectively while at first follow up the mean UCLA in control group and experimental group was 19.08 ± 4.21 and 18.69 4.85 respectively. More over the mean UCLA at 2nd follow up in control group and experimental group was 22.85 ± 3.82 and 22.23 ± 5.60 and at 3rd follow up the mean UCLA in control group and experimental group was 25.62 ± 3.90 and 26.15 ± 5.39. Total UCLA score was improved from baseline to last follow up (p-value < 0.05). Patients in experimental group had more UCLA score as compare to control group (p-value < 0.05).In group – A efficacy of treatment was observed in 1 (7.7%) patient only while in group B the efficacy of treatment was seen in 8 (61.53%) patients. Group B had statistically and significantly higher efficacy as compare to group-A, p-value < 0.05.

Table 1. Comparison of pain in both study groups over different follow ups

	Group	Mean	Std. Deviation
Pain Before treatment	Group-A	4.15	1.62
	Group-B	3.08	1.44
Pain (1st week)	Group-A	5.38	1.60
	Group-B	4.77	1.64
Pain (2nd week)	Group-A	6.62	1.12
	Group-B	5.62	1.98
Pain (4th week)	Group-A	7.77	0.83
	Group-B	7.08	2.1

- **p-value (comparison over follow ups) = 0.000 p-value (comparison over follow ups vs. study groups) = 0.218**

Keywords

Group A: This was a control group which received Conventional Rehabilitation (CR)

Group B: it was the experimental group that was treated with Repetitive Facilitation Exercise (RFE) and conventional rehabilitation (CR).

Table 2. Comparison of function in both study groups over different follow ups

	Group	Mean	Std. Deviation
Function Before treatment	Group-A	4.00	1.291

	Group-B	4.00	1.958
Function (1st week)	Group-A	4.08	1.320
	Group-B	4.38	1.981
Function (2nd week)	Group-A	5.08	1.553
	Group-B	5.46	1.984
Function (4th week)	Group-A	5.85	1.725
	Group-B	6.31	2.175

- p-value (comparison over follow ups) = 0.000 p-value (comparison over follow ups vs. study groups) = 0.2618

Keywords

Group A: This was a control group which received Conventional Rehabilitation (CR)

Group B: it was the experimental group that was treated with Repetitive Facilitation Exercise (RFE) and conventional rehabilitation (CR).

Table 3. Comparison of active forward flexion in both study groups over different follow ups

	Group	Mean	Std. Deviation
Active forward flexion Before treatment	Group-A	2.23	0.59
	Group-B	2.26	0.72
Active forward flexion (1st week)	Group-A	2.69	0.75
	Group-B	2.54	0.66
Active forward flexion (2nd week)	Group-A	3.31	0.63
	Group-B	3.23	0.72
Active forward flexion (4th week)	Group-A	3.69	0.63
	Group-B	3.89	0.25

- p-value (comparison over follow ups) = 0.000 p-value (comparison over follow ups vs. study groups) = 0.673

Group B: it was the experimental group that was treated with **Keywords**
Repetitive Facilitation Exercise (RFE) and conventional
rehabilitation (CR). **Group A:** This was a control group which received
Conventional Rehabilitation (CR)

Table 4. Comparison of strength of forward flexion in

Keywords

Group A: This was a control group which received
Conventional Rehabilitation (CR)
both study groups over different follow ups

	Group	Mean	Std. Deviation
Strength of forward flexion Before treatment	Group-A	2.08	0.76
	Group-B	2.15	0.80
Strength of forward flexion (1st week)	Group-A	2.46	0.660
	Group-B	2.69	0.75
Strength of forward flexion (2nd week)	Group-A	3.23	0.59
	Group-B	3.38	0.87
Strength of forward flexion (4th week)	Group-A	3.69	0.48
	Group-B	3.77	0.83

- p-value (comparison over follow ups) = 0.000
- p-value (comparison over follow ups vs. study groups) = 0.853

Keywords

Group A: This was a control group which received
Conventional Rehabilitation (CR)

Group B: it was the experimental group that was treated with Repetitive Facilitation Exercise (RFE) and conventional rehabilitation (CR).

Table 5. Comparison of patient's satisfaction in both study groups over different follow ups

	Group	Mean	Std.

			Deviation
Patient satisfaction Before treatment	Group-A	1.46	0.66
	Group-B	1.08	0.27
Patient satisfaction (1st week)	Group-A	4.46	0.77
	Group-B	4.38	1.11
Patient satisfaction (2nd week)	Group-A	4.62	0.76
	Group-B	4.69	0.75
Patient satisfaction (4th week)	Group-A	4.79	0.45
	Group-B	4.97	0.59

- p-value (comparison over follow ups) = 0.000
- p-value (comparison over follow ups vs. study groups) = 0.047

Keywords

Group A: This was a control group which received Conventional Rehabilitation (CR)

Group B: it was the experimental group that was treated with Repetitive Facilitation Exercise (RFE) and conventional rehabilitation (CR).

Table 6. Comparison of ucla score in both study groups over different follow ups

	Group	Mean	Std. Deviation
UCLA score Before treatment	Group-A	13.92	4.310
	Group-B	12.62	4.464
	Total	13.27	4.350
UCLA score (1st week)	Group-A	19.08	4.212
	Group-B	18.69	4.854
	Total	18.88	4.457
UCLA score (2nd week)	Group-A	22.85	3.826
	Group-B	22.23	5.600

UCLA score (4th week)	Total	22.54	4.709
	Group-A	25.62	3.990
	Group-B	26.15	5.398
	Total	25.88	4.659

- p-value (comparison over follow ups) = 0.000
- p-value (comparison over follow ups vs. study groups) = 0.02

Group B: it was the experimental group that was treated with Repetitive Facilitation Exercise (RFE) and conventional rehabilitation (CR).

Table 7. Comparison of efficacy of treatments in both study groups over different follow ups

		Study Groups		Total
		Group-A	Group-B	
Efficacy	Yes	1 (7.7%)	8 (61.53%)	9 (34.61%)
	No	12 (92.3%)	5 (38.46%)	17 (65.38%)
Total		13 (100%)	13 (100%)	26 (100%)

P-value = 0.04

Keywords

Group A: This was a control group which received
Conventional Rehabilitation (CR)

Group B: it was the experimental group that was treated with Repetitive Facilitation Exercise (RFE) and conventional rehabilitation (CR).

DISCUSSION

There are various physiotherapies which have been built to enhance functional recovery in patients with a hemiplegic upper limb due to stroke or acquired brain injury, which includes the facilitation technique with proprioceptive neuromuscular facilitation the Brunnstrom approach, the Bobath approach, electromyography (EMG)-initiated electrical stimulation, increased intensity physiotherapy, constraint induced movement therapy, computerized arm training, early and repetitive sensorimotor stimulation of the arm, transcranial magnetic stimulation (TMS) and thermal treatment for the hemiplegic upper limb to make possible sensory and motor recovery. The standard neurophysiological facilitation techniques used for hemiplegic upper limbs have not been affirmed to enhance the functional progress of hemiplegic limbs. Previous studies on the efficacy of these neurophysiological approaches in promoting the functional recovery of hemiplegia have been limited by the small numbers of patients included, which have reduced the chance of detecting statistically

significant differences, and by the use of measures that are not sufficiently sensitive to detect small improvements in motor function.

In addition to the limitations associated with study design, these neurophysiological approaches mainly aim to normalize muscle tone or asymmetric posture and not to strengthen neuronal circuits through the injured descending motor tracts by repetition of the patient's intended movements. A study was done to calculate the effects on the hemiplegic upper limb of repetitive facilitation exercises (RFEs) using a new facilitation technique, in which the patient's intent to move the hemiplegic upper limb or finger was aided by realization of the movement using multiple sensory stimulations. Twenty-six stroke patients were included in a cross-over study in which 2week RFE sessions (100 repetitions each of five-to-eight types of facilitation exercise per day) were exchanged with 2-week conventional rehabilitation (CR) sessions, for a total of four sessions (Kawahira, Noma et al. 2009). In their trial treatments were started with the 2-week RFE session in one group and the 2-week CR session in the

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second group. The new RFEs enhanced the functional recovery of the hemiplegic upper limb and hand to a greater extent than the CR sessions (Kawahira, Noma et al. 2009). Beverley French et al (2009) conducted randomized/quasi-randomized trials in young after stroke to estimate. Repetitive task training for enhancing functional ability after stroke. Fourteen trials with 17 intervention-control pairs and 659 participants were included. Primary outcomes: results were statistically important for walking distance (mean difference (MD) 54.6, 95% CI 17.5 to 91.7); walking speed (standardized mean difference (SMD) 0.29, 95% CI 0.04 to 0.53); sit-to-stand (standard effect estimate 0.35, 95% CI 0.13 to 0.56); and of borderline statistical importance for functional ambulation (SMD 0.25, 95% CI 0.00 to 0.51), and global motor function (SMD 0.32, 95% CI -0.01 to 0.66).(French, Thomas et al. 2009) There were no statistically important variations for hand/arm function, or sitting balance/reach. Secondary results: results were statistically important for activities of daily living (SMD 0.29, 95% CI 0.07 to 0.51), but not for quality of life or impairment measures. There was no evidence of worse effects. Follow-up measures were not important for any result at six or 12 months. Treatment effects were not changed by treatment amount or timing, but were changed by treatment type for lower limbs (30).

In present study we reported some detailed results in terms of UCLA score improvement i.e., UCLA contains Pain, function, active forward flexion, strength of forward flexion, patient's satisfaction and UCLA score / efficacy of treatments. We found that overall pain improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05). our investigation also led us to conclude that function of patients improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05). Moreover, similar statistics regarding active forward flexion are found i.e., overall active forward flexion and strength of forward flexion was improved from baseline to last follow up (p-value < 0.05) with non-significant difference in both study groups (p-value>0.05). Patient's satisfaction was improved from baseline to last follow up (p-value < 0.05).

Patients in B group had more satisfaction as compare to A group (p-value < 0.05). Patients in B group had more UCLA score as compare to A group (p-value < 0.05). In group – A efficacy of treatment was observed in 1 (7.7%) patient only while in group B the efficacy of treatment was seen in 8 (61.53%) patients. Group B had statistically and significantly higher efficacy as compare to group-A, p-value < 0.05. Another study was taken on 22 subjects with stroke and 2 brain tumor operated subjects.Two 2-week facilitation technique sessions (more than 100 repetitions a day for each of 5 kinds of

movement) were given at 2-week intervals in patients with hemiplegia, who were being treated with continuous conventional rehabilitation exercise without the facilitation technique for hemiplegia. Motor function of the affected lower limb (Brunnstrom Recovery Stage of hemiplegia, the foot-tap test and the strength of knee extension/flexion) and walking velocity were calculated at 2week intervals. The betterment after facilitation technique and conventional rehabilitation exercise sessions were significantly more than those after the preceding conventional rehabilitation exercise sessions (Kawahira, Shimodozono et al. 2004).

Conclusion

In present study we reported efficacy of Repetitive Facilitation Exercise (RFE) and conventional rehabilitation (CR) combined has significant effect on patients' satisfaction, total UCLA score and its efficacy. In group – A efficacy of treatment was observed in 1 (7.7%) patient only while in group B the efficacy of treatment was seen in 8 (61.53%) patients. Group B had statistically and significantly higher efficacy as compare to group-A, p-value < 0.05.

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