

Effects of Perfetti's Method on Cognition, Dexterity and Sensory Motor Function of the Upper Extremity in Stroke Patients: A Randomized Controlled Trial

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²Conception and design, ³Collection and assembly of data, ^{1,2,3}Analysis and interpretation of the data, ^{Statistical expertise, drafting of article, ⁴Critical revision of the article for important intellectual content, ²Final approval and guarantor of the article.}

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A B S T R A C T

Background: A stroke is the sudden loss of neural function caused by an interruption of blood flow to the brain. It causes symptoms such as paresis, hypoesthesia, cognitive impairment, and spasticity.

Objective(s): To compare the effects of Perfetti's Method versus routine physical therapy on the upper extremities' cognition, dexterity, and sensorimotor function in stroke patients.

Methodology: In this study, 74 stroke participants were enrolled and randomized into two groups by the Goldfish Bowl Procedure, with 37 patients in each group. Group A was treated with routine physical therapy, and Group B was treated with Perfetti's Method and routine physical therapy. The measurements of both groups were recorded at the beginning of the study and after the 12th post-treatment week. Sensorimotor function was measured with the Fugal-Meyer Assessment Upper Extremity (FMA-UE), dexterity was measured with the Box and Block Test (BBT), and level of cognition was measured with the Mini-Mental State Exam (MMSE) in both groups at the beginning of the study and after the end of training (12th post-treatment week).

Results: According to this study, 74 participants had a mean age of 53.21 ± 12.02 ; males were 45(60.8%), and females were 29(40.2%). The mean Body Mass Index was 23.23 ± 3.47 . The right side was affected by 32(43.2%), and Left Side was affected by 42(56.8%). Sensorimotor Function mean was Pre-treatment 66.70 ± 26.88 and post-treatment 110.09 ± 11.91 . The level of cognition mean was pre-treatment 22.62 ± 3.30 and post-treatment 29.31 ± 1.47 . Dexterity means Pre-treatment was 8.18 ± 11.64 and post-treatment was 84.48 ± 15.03 . P-Value was 0.00, which was < 0.005 , which means that there was a significant difference between the mean value of pre-treatment and post-treatment Sensorimotor function, Level of Cognition, and Dexterity. There was a significant difference between the mean values of Groups A and B in sensorimotor function, level of cognition, and dexterity, as the P-values were 0.027, 0.04, and 0.02, respectively.

Conclusion: Perfetti's Method, combined with routine physical therapy, resulted in significantly improved cognition levels, dexterity and sensory motor function in the upper extremity of stroke patients compared to those receiving only routine physical therapy.

Keywords: Cognition, Dexterity, Perfetti's, Stroke, Sensorimotor.

Introduction

Stroke is the abrupt loss of neurological function caused by a disruption of the blood flow to the brain.¹ It can be divided into two main categories: ischemic and hemorrhagic.^{2, 3}

It causes muscle weakness, decreased sensory function, cognitive impairment, spasticity, excessive reflexes, apraxia, and agnosia.⁴ Upper limb hemiparesis after stroke is a common debilitating and persistent problem. Motor impairments and limitations in the use of the upper limbs have been identified as

the main factors contributing to reduced health and quality of life post-stroke.⁵Stroke affects around 15 million individuals annually globally.⁶ Approximately 6 million people die, while 5 million become permanently disabled.⁷ In the acute stage following a stroke, around 70–80% of stroke patients experience motor and somatosensory deficits of the upper limb, which continues in 55-75% of these individuals for six months after the stroke.⁸The most significant risk factors that can cause stroke are hypercholesterolemia, dysrhythmia, hypertension, atrial fibrillation, and smoking. However, some other risk factors include migraines, and oral contraceptive pill intake are other risk factors for stroke that are usually observed in females.⁹

A distinctive, comprehensive rehabilitation program, cognitive sensorimotor therapy, involves systematic training and retraining of guided sensorimotor control. It is referred to as Perfetti's Method since Professor Carlo Perfetti proposed it. It is frequently used in several European nations today, such as Austria, Germany, and Italy.¹⁰

Perfetti's Cognitive Sensory Motor Training Therapy is distinguished by its focus on sensory retraining, especially the perception of joint position. For example, Patients who cannot accurately describe the joint's location are asked to feel and predict where the limb has moved while wearing blindfolds. The therapist then passively moves the affected limb. One joint is initially only moved at a time. Then, by the patients best perception, various joints are manipulated concurrently to increase complexity and difficulty. Only patients who could accurately assess the location of the limbs were allowed to move on to the following training phase. They are instructed to use effort to actively move the trained limb over a stationary item during this stage of exploratory movement in order to sense the object's length, height, hardness, or shape.¹⁰ The purpose of Perfetti's Method is to improve upper extremity motor impairment or disability.^{11, 12, 13}

Methodology

A randomized controlled trial was conducted. Data was collected from DHQ Teaching Hospital Dera Gazi Khan and Central Park Teaching Hospital Lahore. The study was completed within nine months after the approval taken from university of Lahore ethical committee (ref no: IRB-UOL-FAHS/1005/2021). The calculated sample size is 37 in each group. I.e., n =74 (37 in each group). By adding a 20% dropout rate, the final sample size was 88 (44 in each group).¹⁰ Non-probability purposive sampling technique was used for data collection. Patients fulfilling the inclusion criteria were divided randomly into groups (Group A/Control Group and Group B / Experimental Group) using the Goldfish Bowl Procedure. Participants included those aged 18-79 years, Both male and

female, Diagnosed with all types of Stroke patients with an onset of not more than 3 months, and Fugal-Meyer Assessment Upper Extremity (FMA-UE) score was higher than 60.¹⁰ Participants excluded were those with Other neurological disorders, Orthopedic disease impairing arm function, Fracture of the Arm, Frozen shoulder, No previous history of Stroke and Re stroke during the study.¹⁰ Equipment used in this study was Chair, Blindfold, Stick, Cube, Tennis ball and Pen. In the study, Patients were divided randomly into two groups.

Group A was the Control Group, and Group B was the Experimental Group using the Goldfish Bowl Procedure. All assessment tests were performed before and after the 12th week of treatment. The sensorimotor function was Assessed with Fugal-Meyer Assessment Upper Extremity (FMA-UE)^{1, 14} Dexterity was assessed with box and block test, and cognition was assessed with Mini-Mental State Exam(MMSE)

Group A: Participants were treated with routine physical therapy for 20 minutes five days a week for the 12th week. Activities included routine Physical therapy such as Bimanual placing cone, Graded pinch exercise, Arm bicycling, Double-curved arch, shoulder curved arch, Block-stacking, Skateboard-supported arm sliding exercises on a tabletop, Putty kneading, Pegboard exercise, Picking up a ball and putting it into a basket, Plastic cone stacking. Depending on the patient's ability, therapists may offer active assistance, active training, or passive.¹⁰

Group B: In this group, Perfetti's Method and routine physical therapy treatment were given for 35 minutes five times a week for 12 weeks. A therapist treated only one patient. At the time of treatment, the patient was first blindfolded and then asked to feel the movements of the limb. The therapist passively moved the shoulder, elbow, wrist, or finger in different directions. After completing the movement, the patient was asked about it. Initially, only two movements were asked. If a patient answered correctly, he would be asked about three, four, or five more sides.

During the treatment, the patient was not allowed to do any other movement except rest and feel the movements. The joint can move in all directions, but in training, it was moved in two directions. For example, shoulder flexion/extension, abduction/adduction, internal rotation/external rotation. If the patient had correctly indicated the position of the different joints, he would have been given a more difficult perceptive task. For example, when the patient felt the movement of both shoulders and arms during the task, he was asked what position the arm was on the table in front of him/her.

In stage one, the therapist would move the patient's arm up and down or at another angle, and the arm would be

placed on the table. Then, the patient would be asked to show one or two movements. If he performed two movements, then five more movements were performed. In this way, this training was done on the forearm, wrist, and fingers.

In the next stage, the therapist would give an object in the patient's hand. For example, a stick, pen, water bottle, cube, or tennis ball, and the patient is asked to touch the object and feel its shape, position, and size. This object was again placed in its place, and another object was given. It was also felt in the same way, and the difference between the two and the name of the object was asked. If the patient felt the difference between two objects, he was given more than five objects. In this way, routine physiotherapy treatment was also given to the patient along with Parfittie's Method.

Data was entered into Statistical Package for Social Science (SPSS version 25) for analysis. Quantitative variables were presented in terms of mean, standard deviation, and histograms, whereas qualitative variables were portrayed as frequencies, percentages, and bar or pie charts. Normality tests, i.e., Kolmogorov-Smirnov test, were performed for assessment of the distribution of data, and the significance level for this was $p > 0.05$. If data was normally distributed, for within-group comparison, a Paired sample t-test and between-group comparison, an Independent sample t-test was applied to evaluate the difference between Perfetti's Method versus routine physical therapy on cognition, dexterity, and Sensorimotor function of the upper extremity in stroke patients.

Results

Among 74 participants in group A, 28(75.7%) were male and 9(24.3%) were female. In Group B, among 37 participants, there were 17 males (45.9%) and 20 females (54.1%). In Group A, among 37 participants, the Right Side was affected by 19(51.4%), and the Left Side was affected by 18(48.6%). In Group B, among 37 participants, Right Side was affected by 13(35.1%) and Left Side was affected among 24(64.9%)

P Value was 0.00, which was < 0.005 , which means that there was a significant difference between the mean value of pre-treatment and post-treatment dexterity.

There was no significant difference between the mean values of Pre-Treatment Group A and B Sensorimotor Function as the P-Value was 0.108, while there was a significant difference between the mean values of Post-Treatment Group A and B Sensorimotor Function as the P-Value was 0.027. There was no significant difference between the mean values of Pre-Treatment Group A and B Cognition as P-Value was 1.08, while there was a significant difference

between the mean values of Post-Treatment Group A and B Cognition as P-Value was 0.04. There was no significant difference between the mean values of Pre-Treatment Group A and B Dexterity as P-Value was 0.08, while there was a significant difference between the mean values of Post-Treatment Group A and B Cognition as P-Value was 0.02.

Table I: Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	SD
Age in Group A	37	40.00	73.00	56.21	12.92
Age in Group B	37	28.00	65.00	50.21	11.99
Height (Inches) in Group A	37	60.00	70.00	66.05	3.23
Height (Inches) in Group B	37	60.00	70.00	64.51	3.25
Weight (Kilogram) in Group A	37	45.00	85.00	65.64	13.32
Weight (Kilogram) in Group B	37	45.00	86.00	63.64	13.07
Body Mass Index in Group A	37	17.00	29.50	23.23	3.47
Body Mass Index in Group B	37	17.00	29.50	23.23	3.22

Table II: Paired Sample Statistics.

		Mean	SD	P Value
Pair 1	Sensorimotor Function at Baseline	66.70	26.88	0.00
	Sensorimotor Function at 12th Weak	110.09	11.91	
Pair 2	Cognition at Baseline	22.62	3.30	0.00
	Cognition at 12th Weak	29.31	1.47	
Pair 3	Dexterity at Baseline	8.18	11.64	0.00
	Dexterity at 12th Weak	84.48	15.03	

Table III: Group Statistics for Independent Sample T Test.

Group Statistics				
Variable	Grouping	Mean	SD	P Value
	Variable			
Sensorimotor Function at Baseline	Group A	71.72	22.77	0.108
	Group B	61.67	29.91	
Sensorimotor Function at 12th Weak	Group A	109.72	10.30	0.027
	Group B	110.45	13.47	
Cognition at Baseline	Group A	23.16	2.85	0.160
	Group B	22.08	3.65	
Cognition at 12th Weak	Group A	29.00	1.73	0.04
	Group B	29.62	1.11	
Dexterity at Baseline	Group A	11.35	14.65	0.08
	Group B	5.02	6.30	
Dexterity at 12th Weak	Group A	83.35	14.41	0.02
	Group B	85.62	15.73	

Discussion

Stroke is the abrupt loss of neurological function caused by a disruption of the blood flow to the brain.¹ It can be divided into two main categories, namely ischemic stroke and hemorrhagic stroke.^{2, 3} It causes symptoms such as muscle weakness, decreased sensory function, cognitive impairment, spasticity, excessive reflexes, apraxia, and agnosia. This study's goal is to explain how the Perfetti approach might have enhanced the function of the upper limb in stroke patients. In Group A, among 37 participants, the Right Side was affected by 19(51.4%), and the Left Side was affected by 18(48.6%). In Group B, among 37 participants, Right Side was affected by 13(35.1%), and Left Side was affected by 24(64.9%). Perfetti's Method was more effective than routine physical therapy.

A study was conducted by Ranzani R et al. in 2020, according to which 33 stroke patients were included. The trial was completed by 14 participants in the robot-assisted group and 13 participants in the conventional therapy group. The robot-assisted/conventional therapy group improved on the FMA-UE by 7.14/6.85, 7.79/7.31, and 8.64/8.08 points after the intervention, week eight and week 32, respectively, demonstrating that motor recovery in the robot-assisted group is non-inferior to that in the control group. According to our study, the Pre-treatment Sensorimotor Function mean was 66.70 ± 26.88 , and the Post-treatment Sensorimotor Function mean was 110.09 ± 11.91 . P Value was 0.00, which was <0.005 , which means that there was a significant difference between the mean value of pre-treatment and post-treatment Sensorimotor function.¹⁵

A study conducted by Lin DJ et al. in 2021, according to which Box & Blocks scores were considerably more affected than Grip Strength scores, was consistent across contra-lesional and ipsi-lesional upper limbs. The presence of cognitive impairment explained up to 33% of the variation in Box & Blocks performance but not in Grip Strength performance. While Grip Strength performance was related to injury mostly in sensorimotor areas, Box & Blocks performance was associated with injury across the body, notably in the dorsal anterior insula, a region considered to be critical for complex cognitive function. According to the study, There was no significant difference between the mean values of pre-treatment dexterity as the P-value was 0.08, while there was a significant difference between the mean values of post-treatment cognition as the P-value was 0.02.¹⁶

Conclusion

Perfetti's Method, combined with routine physical therapy, greatly improved cognition levels, dexterity and

sensory motor function in the upper extremity of stroke patients compared to those receiving only routine physical therapy, indicating its potential for enhancing post-stroke recovery in these aspects.

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