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Comparative Study of Effectiveness of Strengthening Exercises with Traditional Approaches in Improving Functional Activities of Hemiplegic Patients

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Abstract

Background: Hemiplegia is a neurological condition which is characterized by unilateral paralysis accompanied by impaired motor control, muscle weakness, stiffness. There are many causes of hemiplegia such as cerebral vasculitis (inflammation of the blood vessels in the brain), meningitis (inflammation of the membranes surrounding the brain and spinal cord), stroke (interrupting of the blood flow to the part of brain). Stroke is the most common cause of hemiplegia which damage the brain cells. It usually damage one side of the brain. If a person's left side brain is damaged then he experience symptoms on the right side and if the right side damaged then he experience symptoms on the left side. It can be known as contralateral hemiplegia. If a person have hemiplegia on the same side of the body as the brain injury then it can be termed as ipsilateral hemiplegia. A person with hemiplegia can experience weakness of the face, arm, leg, on one side of the body

Aim And Objective: The aim of this study is to determine the effectiveness of strengthening exercise in improving functional activities of hemiplegic patients providing evidence-based recommendations for optimized treatment strategies and advancing hemiplegic condition management practices. The objective of this study is to investigate the effectiveness of strengthening exercises in improving functional activities, muscle strength, and overall quality of life in hemiplegic patients, with the ultimate goal of enhancing their functional independence and rehabilitation outcomes.

Methodology: 30 Participants after being screened for eligibility criteria divided into 2 groups by simple random sampling. Group 1 received intervention in the form of strengthening exercise along, Group 2 received rehabilitation protocol of 12 weeks. Effectiveness Parameters were improvement in FMA and MMT. They were assessed at baseline and at the end of the study. Post intervention data was analysed using SPSS software using Mean, Standard deviation, paired 't' test and unpaired 't' test.

Result: There was significant difference in parameters in all the groups from baseline and end of the study ($p < 0.001$). However MET was superior to the change of outcomes like FMA & MMT.

Conclusion: The result of the study states Group A was far superior in result in compared to Group B.

Keywords: Hemiplegia, Stroke, Strengthening exercises, Functional activities

Introduction

Hemiplegia is a neurological condition characterized by unilateral paralysis or significant weakness resulting from damage to brain regions responsible for voluntary movement, balance, and postural control. This condition most commonly occurs following stroke, which causes ischemic or hemorrhagic injury to motor pathways, leading to impaired muscle activation, loss of coordinated movement, and functional disability [12]. Other etiologies include traumatic brain injury, brain tumors, and infections such as encephalitis or meningitis, which disrupt neural circuits and result in contralateral motor deficits [3].

Individuals with hemiplegia often present with muscle weakness, spasticity, exaggerated reflexes, sensory deficits, impaired proprioception, poor balance, and altered gait patterns, significantly limiting mobility and independence in daily activities [4]. If not adequately managed, these impairments may lead to secondary complications such as joint stiffness, muscle shortening, pain, reduced endurance, and decreased cardiopulmonary fitness [5].

Physiotherapy intervention plays a crucial role in the functional re-education of hemiplegic patients, aiming to improve strength, balance, coordination, and independence. Evidence-based interventions include task-oriented training, motor relearning, gait training, upper limb rehabilitation, functional electrical stimulation, and strengthening exercises [6-7]. In particular,

progressive strength training has been shown to significantly enhance muscle performance, functional outcomes, and recovery in individuals with post-stroke hemiplegia [8].

Methodology

Thirty hemiplegic patients aged 45-65 years with lower and upper extremity impairments were noted. The patients were selected as per the criteria and allocated into two groups, A and B. The consent forms taken and teach the interventional protocol to each participants. Both groups received conventional physiotherapy. Group A received strengthening exercise program designed to improve muscle strength, balance, and overall functional independence. Where on the other side Group B has underwent a standardized rehabilitation protocol designed to address multiple aspects of physical recovery, including muscle strengthening, flexibility, balance, and functional training. Each Session lasted between 45-60 minutes for 5 days a week for up-to 12 weeks outcome measures used were Fugl-Meyer Assessment (FMA) and Manual Muscle Testing (MMT). Baseline outcome Measures were recorded and noted on day one of the study and noted till 12 weeks. All data were securely stored for analysis and interpretation.

Table 1: Summary of Demographic and Outcome Measures in Group A and Group B

Parameter	Group A (n = 15)	Group B (n = 15)	Statistical Significance
Age (years)	43.2 ± 10.53	37.8 ± 11.09	p = 0.182 (NS)
Gender (M/F)	8 / 7	10 / 5	Comparable

Table 2: Summary of FMA Score Pre & Post data

Parameter	Group A (n = 15)	Group B (n = 15)	Statistical Significance
FMA Score – Pre	45.5 ± 2.05	45.3 ± 1.66	Baseline matched
FMA Score – Post	68.8 ± 2.31	60.2 ± 1.77	p < 0.001*
FMA Mean Improvement	23.3	14.9	Greater in Group A

Table 3: Summary of MMT Score Pre & Post data

Parameter	Group A (n = 15)	Group B (n = 15)	Statistical Significance
MMT Score – Pre	2.1 ± 0.40	2.0 ± 0.37	Baseline matched
MMT Score – Post	4.2 ± 0.35	3.6 ± 0.32	p < 0.001*
MMT Mean Improvement	2.1	1.6	Greater in Group A

Discussion: The present study compared the effectiveness of strength training and conventional rehabilitation protocols in improving motor recovery and muscle performance in hemiplegic patients. A total of 30 participants were divided equally into two groups. Group A underwent a structured strength training program, while Group B received conventional rehabilitation consisting of range of motion exercises, stretching, and basic mobility training. Outcomes were assessed using the Fugl Meyer Assessment (FMA) for Group A and Manual Muscle Testing (MMT) for Group B, both of which are validated tools in neurorehabilitation. The results showed significant improvements in both groups following intervention; however, the magnitude of improvement was greater in the strength training group. Group A demonstrated a significant increase in mean FMA scores from 45.5 ± 2.05 to 68.8 ± 2.31, with a mean difference of 23.3 points (p < 0.001), indicating enhanced

motor recovery, coordination, balance, and voluntary control. Group B showed an improvement in mean MMT scores from 2.0 ± 0.37 to 3.6 ± 0.32, with a mean difference of 1.6 (p < 0.001), reflecting improved muscle strength. Comparative analysis revealed superior post intervention outcomes in Group A, suggesting that strength training provides greater functional recovery than conventional rehabilitation.

These findings are consistent with evidence that resistance training improves strength and motor function post stroke and may contribute to better independence and quality of life in hemiplegic patients [9-10]. Systematic reviews indicate that resistance training enhances muscular force and motor function more effectively than other therapies, supporting the inclusion of progressive resistance exercises in rehabilitation programs [11]. Neural adaptations such as increased motor unit recruitment and cortical excitability following strength training further explain the superior functional outcomes observed in strength trained participants [12].

Conclusion

Both strength training and conventional rehabilitation improved motor performance in hemiplegic patients. However, Group A (strength training) showed significantly greater gains in motor recovery and functional independence, reflected by higher FMA scores.

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