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| RESEARCH ARTICLE

The Effectiveness of Therapeutic Exercises Accompanied by Electrical Stimulation in the Rehabilitation of Paraplegic Patients in the Elderly

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| ABSTRACT

Therapeutic exercise in combination with electrical stimulation has become an important method to help improve movement and raise functional efficiency in elderly paraplegics. Therefore, this research focused on designing a rehabilitation program with electrical stimulation to raise the functional efficiency of the elderly with paraplegia and to know its effect on the muscle tone of the muscles of the upper and lower extremities of the affected part. In this paper, the researcher used the experimental approach due to its suitability to the nature of the research, using the intentional method in selecting a sample of 8 patients with simple and medium degrees. The results showed the positive effect of rehabilitative exercises with electrical stimulation used in a sample in improving muscle tone and reducing the effects of spasms in it, as well as a positive effect of the rehabilitative exercise program with electrical stimulation in increasing and improving the range of motion, and an improvement was also found in the angles of the joints of the affected limbs as a result of continuous movement and continuation in the performance of the proposed rehabilitation exercises in a sample with the ability of the injured individuals to perform strength training and improve the movement level. In conclusion, the researcher recommends being guided by the therapeutic program in rehabilitation and paying attention to flexibility and orthotics together as two sides of the same coin to get rid of muscle spasm in particular and improve muscle tone in general, and to pay attention to the development of muscle strength, balance, flexibility and views of the affected muscles.

| KEYWORDS

Electric Stimulation, Hemiplegia, Rehabilitation exercise.

| ARTICLE INFORMATION

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1. Introduction

The application of scientific techniques and methodologies has led to a notable improvement in a number of areas of physical education in recent years, particularly those linked to sports health sciences and the rehabilitation of sports injuries. The average health of a nation's youth, the incidence of illnesses, particularly in the elderly, and the average life expectancy of its population are used to gauge the health of that nation. General health is described as "freedom from disease and the physical and mental condition that permits the individual to perform all natural functions" in medical dictionaries. Since it is uncommon for a person to be completely free of illness and weakness, the World Health Organisation defines health as "a state of complete physical and mental well-being, happiness, and social well-being, and not just the absence of disease and infirmity. The exposure of the elderly to several forces, including the force of gravity, affects the body, so the individual's enjoyment of a great deal and a high degree of balance is due to the individual as it works to prevent the body from falling, and works to restore and restore balance after its loss or defect, helps the individual I have to achieve muscular sufficiency and control the direction of its movements, and balance has a close relationship with some other elements of physical fitness, including compatibility and agility in some exercises, and there are many movements that perform on devices that require and require a high degree of balance. (Shiha 2018). We find that the term cerebral palsy includes several types of hemiplegia or double paralysis of the brain that happens in different areas of it,

which is caused by various types of diseases, and therefore, the general symptoms of each type also differ. Cerebral palsy may also result after or during childbirth or at any stage of life and as a product of deformity in brain growth or a lack of oxygen supply to brain tissue (lack of oxygen), or as a result of inflammatory brain infections, such as infection with meningococcal meningitis virus, brain tumors, or pathological tissue erosion in the brain, and this causes many problems in the elderly stage such as the difficulty of movement and performance (Osama,2005). Also, electrical stimulation is one of the means of treatment in various injuries because of its clear and strong effect in returning the affected part to its normal state, as the electrical stimulation associated with exercises and rehabilitative exercises represents an effective effect in improving the level of pain, as it is considered one of the most important and best means of physical therapy and includes almost all cases of treatment Injury due to its ability to penetrate to reach the bones and is also used in the treatment of fibrosis of all tissues and joints.(Adam2019)

***1.1 Research Aims**:*

1. Tone of the muscles in the upper and lower limbs of the research sample's afflicted body part.
2. Strength of the weak muscles in the upper and lower limbs of the research sample's afflicted body part.
3. The research sample's level of balance (stability and mobility).
4. The upper and lower extremities of the afflicted section of the study sample indicate the kinetic range of the joints that operate on the affected half of the body, including the joints (shoulder, elbow, wrist, thigh, knee, and ankle).

1.2 Research hypotheses

1- The pre and post measures of the muscle tone in the upper and lower extremities of the damaged area of the body among the study sample members differ statistically significantly, favoring the post measurements.
2- There are statistically significant differences between the pre and post measurements in the muscular strength of the muscles of the upper and lower extremities of the injured part of the body of the sample members under study in favor of the post measurements.
3- The degree of balance between the muscles in the upper and lower extremities of the afflicted area of the body is statistically significantly different between the pre and post measures among the research sample participants, favouring the post measurements.
4- The range of motion of the joints controlling the affected half of the body, represented by the joints (shoulder, elbow, wrist, thigh, knee, and ankle) of the sample members under study, differs statistically significantly between the pre and post measurements.

2. Materials and Methods

The researcher used the experimental method on one experimental group through the design of the two pre and post measurements as an experimental design. The research community includes elderly people with lateral hemiplegia who attend the clinic. The researcher used the intentional method in selecting the research sample, which consisted of 8 cases of elderly people with lateral hemiplegia from the simple and medium degree of infection between the ages of (55-65) years.

2.1 Sample selection conditions:

The sample should be from the elderly and persistence in continuing the program until the end. The sample should not have any other diseases that affect the results of the study; observe the homogeneity among the sample members in terms of weight, height and age; The absence of any chronic diseases affecting the conduct of the research.

2.2 Methods of data collection:

In collecting data and information related to the research, the researcher relied on the following tools: The researcher, within the limits of his findings and to the best of his knowledge, reviewed the scientific literature, reference and foreign studies, and the international electronic information network, with the aim of building the theoretical framework and achieving the goal of the research among the sample of the elderly.

2.3 Devices and tools used in the rehabilitation program:

Electrophoresis device, Moving Walk, Diagnostic bed, Swiss ball, Side balance board, Sponge mattresses of different sizes, Round balance board, Sandbags of different weights.

3. Results:

As shown in Table **(1)**, there are differences in the rate of change of the pre and post measurements in the variables of muscle tone (MAS) in favor of the post measurement, where the rate of change ranged between (0.000% and 37.037%).

Table 1. Differences in the rate of change between the pre and post measurements in the variables of muscle tone (MAS)

Variants		Pre measurement		Post measurement		average difference	percentage of improvement
		Mean Arithmetic	Standard deviation	Mean Arithmetic	Standard deviation		
	Ankle Flexors	0.000	0.000	0.000	0.000	0.000	**0.000%**
Right arm	Ankle Extension.	0.707	2.750	2.250	0.463	0.500	18.182%
	Hip Adductors	0.518	3.375	2.125	0.354	1.250	**37.037%**
	Wrist joint flexion	0.744	4.375	3.125	0.354	1.250	28.571%
Right leg	Wrist joint Extension	0.000	0.000	0.000	0.000	0.000	0.000%
	Arm Adductor	0.641	2.875	2.000	0.000	0.875	30.435%

As seen in Table **(2),** there are differences in the rate of change of the pre and post measurements in the muscular strength variables (MRC) in favor of the post measurement, where the rate of change ranged between (22.581%:90.576%).

Table 2. The differences in the rate of change between the pre and post measurements in the variables of muscular strength (MRC).

Variants		Pre measurement		Post measurement		Average difference	Rate of change
		Mean Arithmetic	Standard deviation	Mean Arithmetic	Standard deviation		
Right pelvic joint	Fle muscle	2.375	0.518	4.375	0.518	2.000-	84.211%
	Extensor muscles	2.625	0.518	3.625	0.744	1.000-	**38.095%**
Right knee joint	Flexor muscle	2.388	0.354	4.550	0.463	2.163-	**90.576%**
	Extensor muscles	3.125	0.354	3.875	0.354	0.750-	24.000%
Right shoulder joint	Flexor muscle	2.125	0.354	3.500	0.535	1.375-	**64.706%**
	Extensor muscles	2.750	0.463	4.625	0.518	1.875-	68.182%
Right hand wrist	Flexor muscle	3.875	0.354	4.750	0.463	0.875-	**22.581%**
	Extensor muscles	1.875	0.641	3.125	0.354	1.250-	66.667%
Right elbow joint	Flexor muscle	3.750	0.463	4.750	0.463	1.000-	26.667%
	Extensor muscles	2.250	0.463	4.125	0.354	1.875-	83.333%
Right ankle joint	Flexor muscle	1.963	0.518	3.375	0.518	1.413-	71.975%
	Extensor muscles	2.875	0.354	3.875	0.354	1.000-	34.783%

Variants		Pre measurement		Post measurement		average difference	Rate of change
		Mean Arithmetic	Standard deviation	Mean Arithmetic	Standard deviation		
Balance beam walking	Dynamic balance	2.250	0.707	3.375	0.744	1.125-	50.000%
Biodex Balance	Static Balance	2.650	0.214	1.888	0.290	0.762	28.755%
	Constant balance from side to side	1.850	0.131	1.425	0.392	0.425	22.973%
	Stable balance from front to back	2.500	0.220	1.563	0.366	0.937	37.480%
Berg scale	Static Balance	35.625	3.852	52.000	3.207	16.375-	45.965%

As shown in Table (3), there are differences in the rate of change of the pre and post measurements in the balance variables in favor of the post measurement, where the rate of change ranged between (22.973%: 50.000%).

Table 4. Differences in the change rate between the pre and post measurements in the Range of Motion

(N=8)

Variants		Pre measurement		Post measurement		Average difference	Rate of change
		Mean Arithmetic	Standard deviation	Mean Arithmetic	Standard deviation		
R- wrist joint	Fist.	76.250	7.440	80.000	0.000	3.750-	4.918%
	Open hand	18.125	13.076	33.125	10.999	15.000-	82.759%
	Adduction	3.625	1.768	6.875	3.720	3.250-	**89.655%**
	Abduction	37.500	4.629	37.500	4.629	0.000	**0.000%**

Table (4) shows that there are differences in the rate of change of the pre and post measurements in the motor range variables in favor of the post measurement, where the rate of change ranged between (0.000%: 89.655%).

4. Discussion

As illustrated in Table (1) indicate that there are differences in the rate of change of the pre and post measurements in the variables of muscle tone (MAS) in favor of the post measurement, where the rate of change ranged between (**0.000%: 37.037%)** This is considered an indicative result of a decrease in the degree of muscle spasm after applying for the rehabilitation program and using electrical stimulation, as the rate of change of the measurements is inversely proportional to the rate of muscle spasm (i.e. the higher the rate of change between the two measurements, the lower the rate of muscle spasm. A muscle spasm occurs (in the upper extremity flexors, and vice versa in the lower extremity) when the muscle tone increases in the affected muscles, and this is directly proportional to the muscle tone. (N Berker, Y Serlim, 2010).). As a consequence of utilizing an electrical muscle stimulation device to strengthen the extensor muscles, a rate of change (37.037%) in the reflex muscles of the spasmodic muscles was seen(Sally Abu Ela,2016)

As Clarified in Table (2), there are differences in the rate of change of the pre and post measurements in the variables of muscular strength (MRC) in favor of the post measurement, where the rate of change ranged between (22.581%: 90.576%) The highest results for the rate of change of the muscular strength variables ranged from (22.581% to 38.095%), whereas the lowest values ranged from (64.706% to 90.576%) and the highest results from (22.581% to 38.095%). Due to the spastic nature of those muscles in the (upper and lower) limbs, which were represented by (flexors in the upper limb and extensors in the lower limb), the researcher focused on those muscles in a low and simple manner, which led to the results of the low rate of change of the muscular strength variables. One of the proposed rehabilitation programmes was to concentrate on the muscles that showed high results, as those reflex and weak muscles were represented (the extensor muscles in the upper limb and the flexors in the lower limb), by focusing on them in a larger size and using auxiliary devices like the electrical stimulator and rehabilitative exercises of various kinds, starting from forced exercises and ending with exercises with different resistances (Amy K. Hegarty et al.,2018).).

The results of Table (3) show that the variables are balanced in favour of the post measurement, where the rate of change varied between (22.973%: 50.000%), The proposed rehabilitation programme, which was applied from the end of the second stage to the end of the third stage, included a variety of balance exercises with and without resistances, starting with adjusting the balance of the torso while sitting and progressing through exercises to strengthen the muscles. These results are the result of the development of balance (static and dynamic). The torso, moving through the modified step with the exercises, the researcher's guidance to the study sample, and the climbing and descending of the ladder in order to achieve stability on the damaged leg for a duration of more than 10 seconds. Additionally, research shows that performing muscle-strengthening exercises helps patients with paraplegia and weak muscles on both sides of the body achieve a condition of muscular balance, which in turn improves the degree of body balance and spine's consistency (Ayman Gnamem,2019).

As Clarified in Table (4), there are differences in the rate of change of the pre and post measurements in the motor range variables in favor of the post measurement, as indicated by the results of tables where the rate of change ranged between (0.000%: 89.655%) The damaged joints did not reach a high level of joint stiffness as a result of the rehabilitation programme that was suggested for a sample of patients with lateral hemiplegia. This was also a result of the frequent, metered workouts and muscle-heating equipment that were used at the start of the sessions, including electrical stimulation and flexibility-building activities software chosen. The significance of flexibility is that it helps to restore the joints' natural range of motion. Flexibility also plays a significant

role in the performance of movements smoothly, effectively, and efficiently, as well as in helping to postpone the onset of fatigue and reduce a person's risk of developing back pain issues(Ayman Gnamem et al., 2019)& (Mufti Ibrahim 2010). The fourth hypothesis, which states that there are statistically significant variations between the pre- and post-measurements in the research sample's improved motor range, has therefore been proven correct.

5. Conclusions

The study's findings and the suggested electrical stimulation-based rehabilitation programme for senior paraplegics who participated in the study revealed:

1- The positive effect of rehabilitative exercises with electrical stimulation used in the research sample in improving muscle tone and reducing the effects of spasms.
2- The physical strength of the muscles in the upper and lower extremities of the damaged area of the body of the sample members under research differs statistically significantly between the pre and post assessments, favouring the post measurements.
3- The ability of the injured people to perform strength training and improve their motor level, resulting in an improvement in the angles of the joints of the affected limbs as a result of the continuous movement and continued performance of the suggested rehabilitation exercises in the research sample.
4- The use of therapeutic activities with electrical stimulation and consistent stability results in an improvement in mobility and walking with balance in the research sample.
5- The result of a successful workout regimen on developing muscular strength.
6- When using the suggested rehabilitation programme, the lateral hemiplegic study sample participants' response times improved amongst one another.
7- The findings of the suggested rehabilitation programme show a discernible increase in motor function; however, the rehabilitation process takes longer for the subsequent actions (gripping fingers and toes).

5.1 Recommendations

The researcher suggests the following, within the constraints of the study sample, in light of what has been discovered, in light of the objectives and hypotheses that have been established, and via the conclusions:

1- Must follow the treatment program's lead while treating older people who have lateral hemiplegia.
2- Focusing on both flexibility and strength as complementary aspects of the same exercise enhances overall muscle tone and gets rid of muscular spasms in the afflicted muscles.
3- Focusing on the elderly paraplegic muscles' growth of muscle strength, balance, flexibility, and stretching.
4- Balance should be developed from a very young age, especially the balance of the torso, since it will affect the body's overall equilibrium in the following phases.
5- Considering the individual variations within the sample to get the best outcomes for the motor rehabilitation process.
6- Any rehabilitation programme is developed around the question of "How many weak and strong muscles are there?" and "What is the range of motion?" This is also the fastest and most effective technique to get improvements.
7- It's important to pay attention to the follow-up measures taken at each stage of the programme method to make sure that things are going well.
8- Applying more rehabilitative studies on different age groups.
9- Trying to use various rehabilitation methods for elderly paraplegics.
10- Paying attention to the early detection of patients with paraplegia in order to obtain faster and better results, as some of them may take years as a result of the wrong programs, the incompleteness of any part of the program, or the delay in the parent's awareness of the injured.

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