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Effect of Eight-Week Selected Exercises on Strength, Range of Motion (RoM) and Quality of Life (QoL) in Patients with GBS

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Abstract

Purpose: Guillain-Barré syndrome is the cause of acute neuromuscular paralysis in which the peripheral nervous system is damaged. The current study was conducted with the aim to determine the effect of eight-week selected exercises on strength, range of motion and quality of life in patients with Guillen-Barré Syndrome (GBS).

Method: This study is a quasi-experimental research with single group pretest-posttest design. Four cases of patients with Guillen-Barré syndrome (girls and boys aged 6 to 18) were purposefully selected and assigned to one group as the sample of the study. Before and after eight-week selected exercises (exercises with theraband and physioball), the strength, RoM, and QoL were measured using manual dynamometer, manual goniometer, and questionnaire (CBCL), respectively. Data were analyzed using SPSS software.

Results: The results of this study showed that following exercises, strength of the ankle ($p \leq 0.05$) and knee ($p \leq 0.05$) was significantly increased, and no significant changes were observed in the strength of patients' hip ($p \geq 0.05$). RoM in ankle joint ($p \geq 0.05$), knee ($p \leq 0.05$), and hip ($p \leq 0.05$) was significantly increased. QoL was increased significantly ($p \leq 0.05$) as well.

Conclusion: This study showed that selected exercises (exercises with theraband and physioball), have led to significant improvement in strength, RoM and QoL in children suffering Guillen-Barré Syndrome, so it can be recommended for patients with Guillen-Barré Syndrome.

Keywords: Guillain-Barré Syndrome; Selected exercises; Strength; Range of Motion; Quality of Life; Rehabilitation

Introduction

Guillain-Barre syndrome (GBS) is a rare neurological condition in which nerve myelin is destroyed, which is similar to a crippling disease with unknown cause [1]. Lendi first reported GBS in 1895 [2]. The annual incidence of this disease is 1 to 2 patients per 100,000 people and is reported worldwide in both genders and all ages. The male to female ratio of GBS was higher, and in some cases it was 1.5 times higher [3]. Lack of reflexes, pain in the organs, weakness of the organs and anesthetizing are considered as clinical signs of the disease [1]. Cerebrospinal fluid (CSF) analysis and electro diagnostic studies are among the most important GBS diagnostic tests [4]. Both intravenous immunoglobulin and plasma replacement therapies reduce the time spent for recovery [5].

The muscle strength is the ability or capacity of a muscle or muscle group to exert the maximum force against a resistance. Muscle weakness or imbalance in muscle groups can cause abnormal movement or displacement in various parts of the body and disrupt normal functioning of the muscle; it can also cause abnormalities to occur in organs. Patients with GBS have difficulty with doing activities such as walking and running independently, and their participation in physical activity decreases due to problems such as weakness and lack of muscular strength [6]. Research has shown that reinforcement exercises can dramatically increase the ability to produce power, and short-term exercises can improve walking, riding wheelchairs and other aspects of motor function [7]. Garssen et al. found that the 12-week training protocol, including warming up and cycling in 20 patients with GBS could improve the symptoms [8]. Nicholas et al. found that high intensity exercise compared to low intensity significantly reduces disability in patients with GBS and increases muscle strength [9]. Bussmann, Garssen, van Doorn, and Stam stated that 12-week physical training improves physical performance up to 44% in patients with GBS [10]. El Mhandi, Calmels, Camdessanché, Gautheron, and Féasson asserted that during 18 months recovery, dynamometric measurements showed a significant increase in strength [11]. After 16-week training, Pitetti, Barrett, and Abbas observed positive improvements in the leg isokinetic strength and performance in daily living activities [12].

The RoM refers to the amount of movement of each joint. Non-flexibility can lead to pain, reduce the RoM and limit the person's performance in daily living activities, and annoy the patient in the short and long term. Muscle shortening is one of the common musculoskeletal disorders and is often associated with pain, limitation of movement, and poor performance of the patient [13]. Many sports medicine researchers know flexibility as one of the most important

factors in the preparation of athletes and introduce having appropriate flexibility as a way to prevent sport injuries. It has even been shown that a limited RoM may be a risk factor for lower extremity damage [14]. Exercise therapy is effective in reducing the pain and increasing the joint's RoM by strengthening the muscles surrounding the joint and reducing the pressure on it [15].

The QoL is a person's image of his position in relation to his goals, expectations, criteria and concerns in the cultural context and the value making system in which he lives. Given this definition, if QoL is properly evaluated, it will be considered as a sensitive and comprehensive criterion to measure the impact of disorders and therapeutic interventions as well as clinical reasoning on determining therapeutic priorities. Examining and improving the QoL in different groups of people and groups of people with disabilities is among the goals and policies of any society [16]. Children with partial paralysis often have defects in the affected organ's function, which influences autonomy, participation, and quality of their life. The key to rehabilitation is to facilitate the growth of manual functioning for the purpose of achieving functional autonomy and social integration of children in different situations of life [16]. A child who is undergoing treatment for GBS may have feeling of sadness, anger, futility, or all of them. Family and friends can help him by supporting and understanding the sick child, and provide him pleasure until he will be fully recovered from the illness. Counseling to a psychologist helps the patient adapt to the conditions of the disease and the quality of the desired life [17].

A study conducted by Garssen et al. showed a training protocol improved anxiety and depression and QoL of subjects [8]. Demir and KöseoĞlu found that 6-month rehabilitation improved the QoL of patients [17]. Davidson, Wilson, Walton, and Brissenden found that physiotherapy led to the improvement of the anxiety and depression scale in the QoL questionnaire and increased the severity of fatigue [18]. Shah and Shrivastava stated that physiotherapy and rehabilitation process had an impact on the QoL of patients with GBS [19].

Since weight training exercises are intense for children, and injuries are more likely to occur in these exercises, theraband is used to strengthen their muscles. With theraband patients can work on all of their muscles and increase their strength and endurance [20]. By involving a greater number of muscle fibers through the activation of muscle spindles and utilizing the muscles elasticity, theraband exercises cause different functional adaptations to occur in the muscles, resulting in better and more consistent muscles function (coordination in muscle application) and more explosive power in practice [21]. Doing resistance training with theraband causes a reduction in pain and an increase in the RoM [22].

Physioball was first used in Switzerland to help with disabled children's physiotherapy. It improves muscle strength and stamina and increases flexibility and balance [23]. The exercises performed by physioball require conscious contractility of the muscles and focus on muscles activation [24]. The instability of the physioball causes quick activation of deep muscles, which is often used in deep sensory stimulation and body sensory system to improve the dynamic and static equilibrium ability [25].

The current study was conducted to determine the effect of eight-week selected exercises on strength, RoM and QoL in patients suffering from GBS.

Method

As GBS is one of the very rare peripheral nerve diseases, after referring to hospitals in Isfahan province, only 4 patients (girls and boys aged 6 to 18) with Guillain-Barre syndrome were found in 2017 and were selected. The general characteristics of this study subjects are presented in Table 1. All of the subjects in this study had motor defects in the lower limbs, which caused their upper limbs disorder. They were able to walk without help, but were unable to do daily activities such as sitting, getting up, balancing and lifting things. Information about the study design, purposes, procedures, benefits and potential risks were presented at the beginning of the study and the informed consent of each participant was obtained. Ethical committee of University granted ethical approval for the study.

Name	Age	Weight(kg)	Height(cm)
Mohammad Reza Jannessari	8	46	133
Hadis Ghaazi	6	21	119
Mohammad Reza Changani	18	62	159
Zahra Moghaddassi	11	53	155

Table 1: The general characteristics subjects.

After completing the research project, coordination was done with physician responsible for patients with GBS regarding research project and patients were tested for the RoM. Participants in this study were researched for 8 weeks (except test and experiment sessions), individually 3 sessions per week (every other day) for about 1 hour with warming up and cooling down under exercises with theraband and physioball.

In order to measure the muscle strength of the subjects, the Commander manual dynamometer was used. The strength test of ankle, knee and hip was performed before and after eight-week selected exercises.

RoM test for joints of the lower limbs (ankle, knee and hip) was performed using a manual goniometer before and after eight-week selected exercises.

To measure the QoL of the subjects, the Achenbach questionnaire (CBCL) with 113 questions about various behavioral patterns of children was used. The CBCL Test is a comprehensive care report to check the behavioral problems of children aged 6 to 18, through which their QoL is determined [26].

In the first session, the principles of performing exercises with theraband and physioball were explained and the subjects and their parents were provided with general information about the benefits of exercises. These principles are observed in all sessions.

Each training session consisted of three parts, the first part included the main movements (warming up 10 minutes plus 5 minutes stretching exercises), the second part consisted of specific movements (exercises with theraband and physioball, 20 minutes), and the third part composed of cool down exercises (10 minutes).

The training period in the following weeks increased so that in the last week, the training time reached to an hour and 10 minutes, which included training with theraband and physioball.

The intensity of the exercises for each subject was controlled on the basis of the tolerance of practicing individuals such that the subjects performed exercises with more repetition without pain and fatigue as exercises went on.

In each session, in addition to the exercises of the previous session, new exercises were also added. This, on the one hand, motivated subjects and, on the other hand, preserved the principle of overload and diversity in exercises.

The training routine was the same for all subjects but the training exercises progress speed was not the same for them, and the exercises were done according to their ability and to the extent that they did not feel tired or painful. Importantly, children suffering from this disease have a lower tolerance threshold, so their tolerance and ability during exercise were considered.

Eight-week selected exercises are shown in Table 2 and in supplementary file.

Week	Set	Main Training	Special Training	Benefits	Used equipment
1st	3 × 8	-Body warming up -Basic and stretching movements	-Doing exercises opposite of gravity	-The muscles and joints are prepared for exerci0073es	-Piece of fabric -Bottle
2nd	3 × 8	-Body warming up -Stretching movements	-Doing exercises opposite of gravity without the help of the therapist	-Strengthening the target muscle	-Chair -Bottle
3rd	3 × 10	-Body warming up -Basic and stretching movements	-Educational training -Doing specialized exercises with physioball	-Preparation of joints and target muscles	-Chair -Stair -Small sponge ball
4th	3 × 10	-Body warming up -Stretching movements	-Resistance exercises with theraband	-Strengthening the central body muscles	-Theraband (red)
5th	3 × 12	-Body warming up - Dedicated warming up movements	-Special exercises with theraband and physioball	-The muscles and joints are prepared for exercises	-Mattress -Physioball -Theraband (red)
6th	3 × 12	-Body warming up -Stretching movements	-Central body exercises	-Strengthening muscles, tendons, ligaments and joints	-Chair -Pillow -Physioball
7th	3 × 15	-Body warming up - Dedicated warming up	-Strength exercises in the central body	-Strengthening muscles and joints	-Pillow -Piece of fabric -Theraband (green)
8th	3 × 15	-Body warming up -Stretching movements	-Resistance and balance exercises	- Strengthening pelvic floor muscles	-Desk -Physioball -Theraband (green)

Table 2: Eight-week exercises.

If necessary, the selected exercises were moderated for subjects who felt pain at the time of the exercise, or were unable to maintain their correct position or had less tolerance. In addition, if the researcher felt that the subject lost control during the movements, the exercises

returned to one step back to reach the base level. The observance of this case causes the individual differences of subjects to be considered and leads to lack of pain in them.

Adjustable exercises include standing on one leg, continuous walking, getting up from a seated position and scott.

Statistical Analysis and Results

Data were analyzed using SPSS software (version 22), and Excel software was used for drawing figures. Dependent t-test was used for inter group analysis. Information of the muscles strength and RoM of subjects is shown in Table 3 and Figures 1 and 2.

		Mean		SD	
		Pre-test	Post-test	Pre-test	Post-test
Muscle Strength (N.m)	Ankle	188	196	133	90
	Knee	200	262	105	77
	Hip	173	209	100	87
RoM (degree)	Ankle	23	26	13	11
	Knee	57	71	21	7
	Hip	22	29	12	11

Table 3: Muscle strength and RoM of subjects.

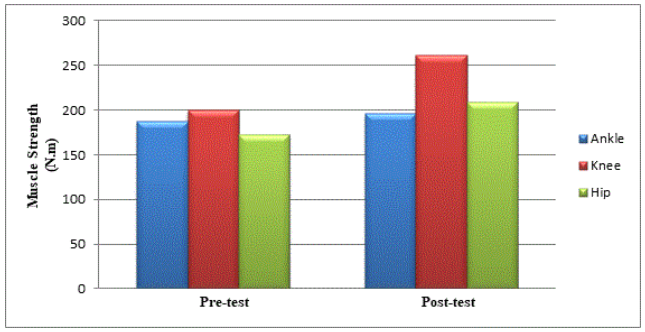

Figure 1: Muscle strength of subjects.

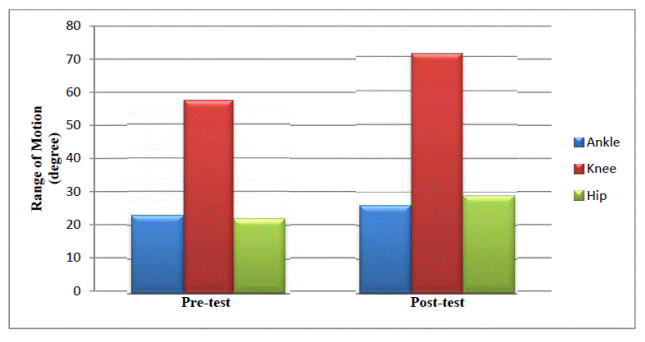

Figure 2: RoM of subjects.

After eight-week selected exercises, the following results are obtained:

Significant differences were observed in the ankle strength of patients with GBS (t=-2, P≤0.05), so that the strength increased by about 4.2% and also in knee stren gth (rectus femoris, vastus intermedius, vastus lateralis and vastus medialis muscles) in patients with GBS (t=-3, P≤0.05), that strength increased by about 31%.

Despite the increased strength (by about 20.8%) of the hip in patients with GBS, no statistically significant difference was observed (t=-2, P≥0.05).

Although the RoM in ankle of patients with GBS increased by about 13%, there was no statistically significant difference (t=-2, P≥0.05).

There was a significant difference in RoM in knee of patients with GBS (t=-2.04, P≤0.05), so that the RoM increased by 24.5% and also in hip of the patients with G BS (t=-8, P≤0.05), that the RoM increased by about 31.8%.

In this study Achenbach questionnaire (CBCL) is filled out by parents of the subjects. Information about the QoL questionnaire is presented in Table 4 and Figure 3.

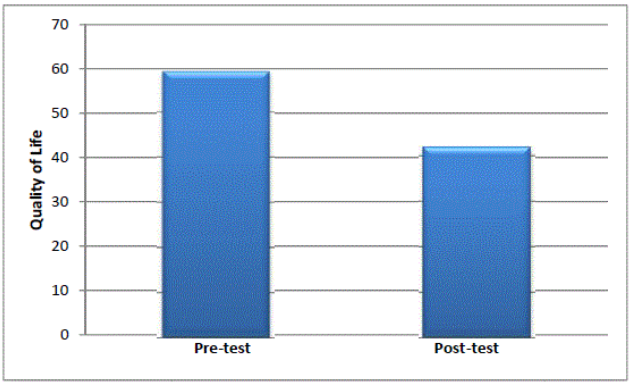

Figure 3: Patients' QoL.

Variable	Training Group (4 person)		
	Pre-test	Post-test	Percent change (%)
Anxious/Depressed	8.25	5.50	33.33
Depressed	6.75	5.00	25.93
Somatic complaints	7.00	3.50	50.00
Social problems	7.00	5.50	21.43
Thought problems	4.75	3.50	26.32
Attention problems	8.50	6.75	20.59
Rule-breaking behavior	4.00	2.75	31.25
Aggressive behavior	13.25	10.00	24.53
Sum of Average	59.50	42.50	28.57
SD	14.00	12.00	14.29

Table 4: The difference between pre-test and post-test scores in CBCL.

Scores in the Achenbach questionnaire (CBCL) are inverse with QoL, the lower scores CBCL causes the higher score s QoL.

There was a significant difference in the QoL of patients with GBS after eight-week selected exercises (t=5, P≤0.05). As shown, the QoL increased by 28.57%.

Discussion

Guillain-Barre syndrome is associated with sensory and dynamic symptoms and often causes the patient not to walk, and leads to complete paralysis. Children with partial paralysis often have defects in organs function, affecting autonomy and participation, a nd quality of their life.

Muscle strength plays a role in maintaining balance and balance of organs and general health and athletic skills. Therefore , exercise and physiotherapy can help relieve pain and also prevent or treat the hardening of the muscles that may occur.

The RoM refers to the amount of movement of the joint. Performing RoM exercises helps patient maintain the natural movements of the joints. The RoM exercises can increase blood flow and reduce the risk of blood clots.

Initially, the aim of this study was to improve muscle strength and increase the RoM of joints in patients with GBS, but during the practice of this study has found that the behavior and mood of patients increased significantly and after speaking with their parents and the accuracy of this case it was concluded that taking a QoL test (CBCL) from them.

The QoL in these children is significantly lower than healthy people. One of the factors affecting the QoL of these children which have been referred to in various studies can be physical characteristics, pain, cognition, performance, social status, independence, access to health services and family status. Selected exercises improve and increase the joints RoM in patients with GBS by strengthening the muscles around the joint, reducing pain, reducing muscle weakness, increasing balance, improving physical strength and increasing muscular endurance.

Despite the ever-growing body of research on GBS, still relatively little has been done with regard to GBS treatment via performing selective exercises; therefore the purpose of the present study was to perform selected exercises with simple, portable and accessible devices (theraband and physioball) in order to improve symptoms, reduce costs, and have confidence and daily activities for patients.

Conclusions

The purpose of this study was to determine the effect of eight-week selected exercises on strength, RoM and QoL in patients suffering from GBS. The result of this study showed that selected exercises had a significant effect on the strength of the ankle and knee muscles, knee and hip RoM and QoL in patients with GBS. This result was consistent with those obtained by Garssen et al. [8], indicating that a 12-week training protocol, including warming up and cycling in 16 patients with GBS can improve the illness. Additionally, effects of the exercise program on fitness, muscle strength and disability was found, and strength improved well after exercises. The results were also in agreement with those obtained by Nicholas et al. [9], showing that in comparison to low intensity exercises, high intensity exercises significantly reduce disability in patients with GBS and improve muscle strength and physical performance. Moreover, results were similar with those obtained in studies conducted by Bussmann et al. [10] who stated that 12-week physical training improved physical performance up to 44% in patients with GBS, and Demir and KöseoĞlu [17] who observed six-month rehabilitation in patients with GBS caused significant improvements in their performance, physical fitness status and QoL, and El Mhandi et al. [11] who showed that during the 18-month dynamic measurements recovery, strength improved significantly and recovery and rehabilitation programs yielded close-to-normal performance in patients with GBS, Pitetti et al. [12] who observed that after 16-week training, there was a positive improvement in the strength of foot isokinetic and performance in daily living activities. Moreover, results of our study were consistent with Davidson et al. [18] that showed physiotherapy improved the scale of anxiety, depression and the severity of fatigue in the QoL questionnaire, as well as Noori et al. (2015), indicating that the high

level of upper extremity function improves the QoL in children with Cerebral Palsy. They are also consistent with Shah and Shrivastava [19], revealing that physiotherapy and rehabilitation process in;lfluenced the QoL in patients with GBS. Our results were inconsistent with those obtained by Shah and Shrivastava [19], indicating that disability and functional impairments are permanent after physiotherapy and remain with patient for the rest of his life [8-12,17,19].

From the findings of this study, it can be concluded that selected exercises can improve the strength of the ankle and knee muscles as well as the QoL, and can increase the RoM in knee and hip. Therefore, they can be recommended to be used for patients with GBS.

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