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ERGO EXERCISES ON WORK EFFICIENCY AMONG PARAPLEGIC PATIENT: A SINGLE CASE STUDY

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ABSTRACT

Spinal cord injury (SCI) is the commonest disabling condition in the world. The case study design describes the role of ergo exercises on a 43-year-old male with RTA and having T8 lesion and ended up with paraplegia. A detailed history and physical examination were performed, along with a careful reviewing of the medical records. The patient was on continuous rehabilitation for the past year before this study; the study was done with ergonomic modification with exercises for 12 weeks. Since there were no studies on the ergo exercises on people with paraplegia, this is the first kind of case study conducted to identify the effect of ergo exercises on improving the work efficiency in the T8 paraplegic patient. The patient rate of perceived exertion, spinal cord independent measures III, and Rapid upper limb assessment. This study shows that there is a significant improvement in the functions compared with the pre interventions. This study is the first study on the application of ergo exercises on paraplegic patients to our knowledge.

Keywords: T8 paraplegic, Spinal independent measure, Rapid upper limb assessment, Ergo-exercises, Rate of perceived exertion.

INTRODUCTION

Spinal cord injury (SCI) causes more severe disability among patients following road traffic accidents. In India, about fifteen lacs people live with spinal cord injury, and every year, ten thousand individuals, aged 16—30 years[1]. Injuries below the Thoracic level (T1) are termed paraplegia. It may affect the functions of the lower limbs, trunk, and pelvic organs and may cause impairments to the bowel, bladder, and sexual function[2]. In paraplegia, arm functioning is spared, but the trunk, legs, and pelvic organs may be involved depending on the level of injury. Body control is present in lower thoracic injury patients, and they may be ambulant at home with lower extremity orthoses and a walker[3].

Depending on the levels of the injury, the features would be classified. Usually, injuries below the Thoracic spine (T7) would result in good upper body movements. Trunk balance was fair to reasonable, with little or no voluntary control of bladder and bowel activities. They can operate a manual wheelchair, and even standing is possible with a walking frame or braces[4].

Management of the person with paraplegia is expensive, lengthy, exhausting, and requires multidisciplinary approaches[5]. There are a lot of biophysical, psychosocial, and economic problems[3]. Treatment of patients with spinal cord injury is an ongoing process for many years. It starts soon after the injury with acute care and early surgical interventions to lifelong care at home.

As identified in the literature, the repetitive performances of the tasks are high forces associated with various functions that place multiple demands in the upper extremities and have been implicated as risk factors for strain injury or pain during activities. Ergonomics plays a significant role in the reduction of injuries in people with paraplegia. Exercises along with proper ergonomics make the person work efficiently and improve performance[6]. Wheelchair prescription is an essential part of paraplegic management; Appropriate wheelchair prescription demands utmost attention and care, which involves the assessment and integration of the user needs and the technology.

Work efficiency was measured through direct and indirect methods; this study uses an indirect assessment form of work efficiency through the upper limb activities, perceived exertion, and the impairment scales. The selected tools are highly validated and reliable measures used in practice.

Ergo exercise is a new approach designed to handle musculoskeletal rehabilitation, and it is the currently developing protocol in rehabilitation. It improves the quality of life and makes people with paraplegia socially active. There is no study conducted on applying exercises ergo on people with paraplegia to enhance their function and improve their work efficiency. This is the first kind of study done on a single case.

CASE DESCRIPTION

A 43-year-old male, Mr.Shoukath, met with a road traffic accident a year before, causing fracture of multiple thoracic vertebrae, and surgery took place a year ago. He ended up with a T8 level spinal cord injury. Post surgically, the patient's lower limb muscles, and abdominal muscles were weak, along with bladder and bowel difficulties. The patient is in a rehabilitation setup, and he was on continuous rehabilitation for the past year. The patient has no history of smoking or tobacco usage. He is an occasional drinker, living with his wife and single male child. He was working in a private company, and his expenses were borne by the company, including his rehabilitation.

On examination: Mr. Shoukath was in a wheelchair, and both lower limbs are strapped in the wheelchair; his upper limbs look normal without any obvious muscle wasting. The patient is on a Taylors brace, sitting in a wheelchair. Wheelchair design was terrible, poorly structured, and poorly maintained. He was in continuous rehabilitation, and he looked very depressed and lost his motivation to do exercises. Atrophy is seen in the calf and thigh muscles. The range of motion in the upper limb was complete, and the lower limb was also entire. Lower limb muscles are flaccid (muscle power zero). No active movements of the lower limb were done, whereas, in the upper limb, he was able to do activity in range with restriction in the end. There was marked weakness in the lower limbs, breathing was good, and his upper limb strength was acceptable. He does transfer using a sliding board from the wheelchair to bed or bed to wheelchair. Sensory function is lost below the level of his abdomen, and his current complaints include difficulty propelling the manual wheelchair, inability to stand for long periods, repetitive upper limb fatigue while performing minimal activities, poor balance in standing, poor sitting position, and inability to maintain a comfortable position in the chair.

Muscle tone was evaluated using Ashworth's scale, and the lower limb was 1. All the reflexes in the lower limb were absent, whereas the upper limb was normal. Muscle power testing shows the lower limb was 1+ and upper limb was 4+. The range of motion is not full in the lower limbs. The passive range is normal, whereas the active range of motion is at the initial range.

He lives on the ground floor, and his house was modified with a ramp in the entrance for easy movement of a wheelchair; he has a bedroom with a bath attached, and he is not moving independently in the wheelchair. He always asks for assistance. When the patient was made to sit unsupported sitting, the patient could not maintain balance, and he always requires assistance for sitting and lying. He needs help with upper body and lower body dressing as well as transfer.

This study is designed to create an effective new therapy and the conventional treatment applied for the patient. A clear protocol was made to the patient, and they started practicing the activities in a regular manner for 12 weeks. The rehabilitation program focused on a range of motion, flexibility, joint proprioception, standing balance, and improving fitness in the upper limbs. Therapies focus on reducing the muscle tone, maintaining the range of motion, improving muscle strength, increasing coordination, and preventing skin lesions. Reasonable care is needed to avoid stiff joints and contractures.

WHO guidelines show that exercises are recommended on alternate days, and the activities include Aerobic exercises, weight-bearing exercises, and flexibility exercises[6]. The duration of treatment is for 45—60 minutes, three times a week. The intensity of the workouts was described based on the maximal heart rate (50—60%)[7]. Exercises started with general upper limb exercises, arm ergometer, wheelchair pushing, and seated aerobics. The resistance is minimally added with free weights, weight cuffs, elastic bands, and elastic tubes with intermittent breaks for 3-5 sets. Standing balance was trained with lower limb orthosis and made the patient stand on the parallel bars with support. Gradually, the consent was withdrawn to promote pelvic control and muscle activity of the trunk, hip, and lower limbs.

Sitting balance is believed necessary in performing functional activities from a seated position[8]. In addition to the general exercises, this study focuses on modifying wheelchairs and adding exercises with the use of ergonomics, ergo exercises. The person's wheelchair was modified as seating positions need to be altered to remove high-pressure areas in the buttock regions, provide lumbar support to avoid strain in the lumbar spine[9].

Outcome measures used in the study include Rate of perceived exertion (RPE), Spinal cord independent measures III (SCIM III), and Rapid upper limb assessment (RULA). Initially, the evaluation was done, and these values were taken as pre-intervention data, and the follow-up was done subsequently in the three weeks, six weeks, nine weeks, and 12 weeks. Descriptive analysis of the two scales was done. The study of the data shows that there was progression seen between the weeks; compared to the pre-intervention data, the 12th-week data shows a significant functional improvement. The table shows the progression of the data.

Table I

Outcomes	Pre data	3rd week	6th week	9th week	12th week
RPE	15	15	13	12	11
SCIM III	33	44	50	59	63
RULA	4	4	4	3	3

The result of the 12 weeks study shows there was a significant difference found between the weeks. It was also noted that the patient would be able to do the activities with less effort and less energy usage. However, this study doesn't identify the exact energy used by the patient.

DISCUSSION

Postural stability improvement is made by various factors like biomechanical, sensory, motor, and central nervous system[10]. Conventional wheelchairs are still the most appropriate choice for many clinicians. Prescription of the wheelchair must be fit for the users in respect to the comfortable, mechanical advantage, energy expenditure, and work efficiency.

Selection of inappropriate wheelchairs would result in poor postures, joint deformities, restriction of joint movements and general mobility, pressure sores, circulatory impairments, and actual pain. Ergonomics plays a significant role in creating an economical and user-friendly wheelchair. It has to be altered as per the user's advantage[11]. It was hypothesized that modifications in the wheelchair would cause the metabolic energy demand and cardiac loads to be reduced when compared before.

Poor sitting posture causes stress to the shoulder joint and increases work efficiency and workload to the shoulder, resulting in shoulder pain[12], alteration of the seating posture in the wheelchair and the exercises to the shoulder reduces the pain ultimately, and the activity of the shoulder improves.

Ergo exercises play a significant role in improving the patient's posture; in addition to that, it also enhances functional activity. In addition to it, there is an improvement in cardiorespiratory fitness, which was identified using the RPE, which shows a considerable significance when compared with the previous scores. The upper limb and trunk posture were measured using RULA, which shows improvement, and the SCIM III.

The study limitation is that it is the first kind of study which applies ergonomics and exercises on paraplegic patients. This study cannot measure the actual energy consumed by the patient before and after the ergo exercises. The patient's emotional, psychological factors are not part of this study; however, there was counselling given to the patient before the study by a psychologist.

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