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EFFECTIVENESS OF MODIFIED UPPER LIMB SPORTS ON HAND FUNCTION IN TETRAPLEGIC SPINAL CORD LESION PATIENT

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Bachelor of Science in Physiotherapy (B.Sc. in PT)

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled.

Effectiveness of Modified Upper limb sports on Hand Function in Tetraplegic Spinal Cord Lesion Patient

Submitted by Sultana Yasmin, for the partial fulfilment of the requirement for the degree of Bachelor of Science in Physiotherapy (B.Sc. in PT).

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DECLARATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also declare that for any publication, presentation or dissemination of the study. I would be bound to take written consent from the Department of Physiotherapy of Bangladesh Health Profession Institute (BHPI).

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Acronyms

ASIA	American Spinal Injury Association
ISNCSCI	International Standard for Neurological Classification of SCI
BHPI	Bangladesh Health Professions Institute
BMRC	Bangladesh Medical Research Council
CRP	Centre for the Rehabilitation of the Paralysed
IRB	Institutional Review Board
PT	Physiotherapist
DASH	Disability of Arm, Shoulder, Hand
SCL	Spinal Cord lesion
RTI	Respiratory Tract Infection
UTI	Urinary Tract Infection
SPSS	Statistical Package for Social Sciences
TSCI	Traumatic Spinal Cord Injury
WHO	World Health Organization

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ABSTRACT

Purpose: The purpose of the study was to elicit the effectiveness of modified upper limb sports on hand function in tetraplegic Spinal Cord Lesions patients at CRP. **Objectives:** To explore the socio-demography information, determine the effectiveness of upper limb sports on the motor score, and impact of modified sports on hand function. **Methodology:** The dissertation was an experimental study with a Quasi-experimental study design. From 20 June to 20 September 2021, 20 people with SCL participated in this study from the inpatient treatment service of Spinal Cord Injury Unit, Physiotherapy Department, Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka. Patients with tetraplegia who participated in boccia sports were eligible for inclusion and patients with seizure disorders were excluded from this study. A structured questionnaire had used for socio-demographic information, ASIA impairment scale, and DASH scale. A statistical test has been conducted as per the distribution of data. Descriptive statistics have been performed by mean, SD, frequency, percentage. Inferential statistics has been performed through paired t-test and Wilcoxon tests. **Results:** This study showed male participants about 95% (19) and 5% (1) were female. Males were more affected than females. The most vulnerable age range was 21 to 30 years. Significant changes have been noted in the total sensory-motor, DASH score. Sensory score changes[MD 26.550±39.717, 95% CI (45.138, 7.962), t 2.99, P<.01];total motor score [MD 12.400±17.089, 95% CI (20.398, 4.402), t 3.245, P<.01]; total DASH score [MD 10.13± 5.54, 95% CI (7.53, 12.72), t 8.18, P <.001]; **Conclusion:** Boccia sports had significant effect in hand functions and neurological status in patients with tetraplegic Spinal cord lesion in their rehabilitation phase. Future RCTs are recommended for the isolated effect of the game.

Key Word: Spinal Cord Lesion, Tetraplegia, Boccia sport's, Hand function.

CHAPTER-I INTRODUCTION

1.1 Background

The spinal cord is the main channel for movement and sensory information between the brain and the rest of the body. The spinal cord has longitudinally oriented spinal tracts which are white matter that surround core portions called gray matter, which comprise the majority of spinal neuronal cell bodies. Sensory and motor neurons are arranged into segments in the gray matter (Kirshblum et al., 2011). Axons from spinal sensory neurons enter the spinal cord via segmental nerves or roots, and axons from motor neurons exit via segmental nerves or roots (Marino et al., 2003)

A spinal cord injury (SCI) is one of the most devastating and life-altering events that can happen to anyone (Kumar et al., 2016). The sudden and unexpected occurrence of spinal injuries can result in a significant change in the person, family, and daily activities of the individual with SCI (Kang et al., 2014).

Damage to neural parts of the spinal canal which consist of the spinal cord, cauda equina, and spinal nerves is known as spinal cord injury (SCI), and it commonly results in lifelong impairments of motor, sensory, and/or autonomic function. Etiology can be traumatic like a car accident, fall from height, or non-traumatic like myelomeningocele, spinal stenosis, transverse myelitis, tuberculosis, and tumor (Tweedy et al., 2017). Marino et al. (2003) stated that Conduction of sensory and motor signals across the lesion site is affected by spinal cord injury (SCI).

The effects of spinal cord damage on body's neuromusculoskeletal and cardiovascular functioning systems. Also affects person walking, grasping, lifting, and carrying function and also society like employment, sports participation, social engagement. (Tweedy et al., 2017). Functional difficulties, such as motor and sensory impairments, bladder and bowel emptying, blood pressure sore respiratory problems, are common among people with SCI, and they frequently result in limitations in activities and participation, such as mobility, self-care, communication, and domestic life (Herrmann et al., 2011)

Traumatic spinal cord injury (SCI) may result in tetraplegia which causes arms, trunk, and legs motor, sensory and autonomic nervous system impairment. Also can result in

paraplegia which causes impairment of the trunk and/ or legs(Gomes-Osman et al., 2017). Depending on the severity of the injury, SCI can result in quadriplegia or paraplegia, which affects the functioning of the limbs, trunk, pelvic organs, bladder, and intestine, as well as sexual function (Kumar & Gupta, 2016)

Tetraplegia is resulting from cervical spinal cord injury and which causes impairment or loss of sensory function and control of the upper extremity (UE).Functional task performance has become limited because of this impairment. It also lessens the quality of life and restricts independence(Gomes-Osman et al., 2017).Paraplegia is a word that describes the loss or impairment of motor and/or sensory function in the thoracic, lumbar, or sacral segments of the spinal cord as a result of damage to a neuronal element within the spinal canal (Kirshblum et al., 2011). Arm function is preserved in paraplegia, but this depends on the severity of the injury. The trunk, legs, and pelvic organs may all be affected. The term is used to describe lesions to the cauda equina and conus medularis, but not to describe a lumbosacral plexus lesion or a peripheral nerve injury outside the spinal canal (Marino et al., 2003)

A disrupted sympathetic nervous system is common in people with tetraplegia, which can include bradycardia, orthostatic hypotension, autonomic dysreflexia, temperature dysregulation, and sweating problems. Cardiovascular responses to exercise may be disrupted depending on the location and degree of the lesion. Inactivity and deconditioning can also be caused by secondary problems such as urinary tract infections, spasms, pressure sores, and overuse injuries in the upper extremity (Valent et al., 2009)

Due to cervical damage, almost half of all people with spinal cord injury have tetraplegia (Raineteau & Schwab, 2001). Individuals with cervical SCI are considerably limited in their capacity to undertake basic activities of daily living impairment of hand function. Total SCI just below 6th cervical level preserves some hand and wrist function, but complete SCI at the C6 neurological level impairs all hand function save wrist extension with radial deviation. There is no hand function above the 6th cervical level due to full damage. Individuals with partial cervical lesions, regardless of the level of the lesion, may have various degrees of arm and hand function (Beekhuizen & Field-Fote, 2005).

With reduction or loss of motor and sensory function, there is a loss of hand and upper limb function (Zbogar et al., 2008). Individuals with tetraplegia experience a variety of changes in addition to a loss of sensation, muscle function, and movement. These changes can affect bowel and bladder function, sexual functioning, gastrointestinal function, swallowing ability, blood pressure, temperature regulation, and breathing ability (Tasiemski et al, 2013).Furthermore, wheelchair users are more likely to develop secondary health issues such as pressure ulcers, UTI, obesity, metabolic disorders, diabetes, and heart disease(Myers et al., 2007).

Some of these long-term issues can be avoided with physical activity and training. As a result, clinical rehabilitation should not only aim for functional goals, as well as for the greatest degree of fitness attainable, ideally influencing the adoption of an active lifestyle (Fernhall et al., 2008). Other aerobic exercise methods are accessible to promote the physical ability of patients with SCI during clinical rehabilitation: swimming, wheelchair training, fitness, and various sports including wheel-chair basketball and tennis (van Drongelen et al., 2006)

To improve lost hand strength and dexterity, passive and active assistive devices are becoming increasingly popular (Cappello et al., 2018). In the early stages of tetraplegia treatment, intense functional training and the use of orthoses are combined. The therapy tries to keep joints mobile, improve the function of innervated muscles, and teach compensatory motions. Orthoses such as writing splints and customized aids are used to increase independence based on the patient's impairment status. When there is no longer any hope of success with this strategy, augmentative therapy approaches can be pursued (Snoek et al., 2000).

Within the restrictions of a neurological disability, rehabilitation therapy works to achieve optimal independence. Appropriate upper extremity therapy in patients with tetraplegia is critical in this regard. Spinal cord injury can be treated with reconstructive surgery or, more recently, the use of neuroprostheses (Waters & Mucitelli, 2002).Several studies have documented the outcomes of these procedures (Alon& McBride,2003). According to Moberg, around 60% of those who have tetraplegia could be benefited from reconstructive surgery (Snoek et al., 2005). Reconstructive arm-hand surgery has gathered a lot of experience over the previous few decades. Tendon transfers are normally reserved for individuals who have been

neurologically stable for at least six months. Patients require time to accept their limitations, maximize their residual physical strength, and learn new abilities (snoek et al., 2000).

Regular exercise enhances cardiorespiratory fitness, improves muscular fitness, improves function, decreases strain during the activity of daily living, and lowers the risk of secondary disease in those who have had a spinal cord injury (Barfield et al., 2010). Persons with spinal cord injuries (SCI) have been widely investigated in terms of their participation in sports. The physiological and psychological benefits of participating in sports after a spinal cord injury have primarily been demonstrated in paraplegics. Unfortunately, there is very little research on sports for patients with cervical spinal cord injury (Slater et al., 2004).In recent years, research interest has rightly aimed to identify potential approaches to improve the hand function of patients with tetraplegia (Harvey et al., 2016).Numerous secondary complications may arise from cervical SCI including deep vein thrombosis, hetero topic ossification, pressure ulcers, and spasticity. Persons with tetraplegia despite their disability may practice several different sports such as swimming, table tennis, archery, or boccia (Pasek et al., 2010)

1.2. Justification:

CRP plays an important role in delivering therapeutic intervention for patients with spinal cord injuries. To provide intervention for the patient, therapists employ a variety of strategies. In the acute phase, SCI patients are usually bed bounded and their activity need is low but when they are in the rehabilitation stage their activity need is high like they want to propel their wheelchair independently, eat independently, groom independently. Spinal cord injured patient faces a lot of physical complications and problem, upper limb problem is one of them. After spinal cord injury muscle shortening, weakening of the muscle, muscle contraction disorder are common which make limb movement more difficult. So they can't move their upper limb purposefully. Fine motor movement is quite impossible and gross motor movements are also difficult for them. They suffer a lot for that reason. They remain completely dependent on their family members/carer. So that they badly need to regain their upper limb function. Nowadays centers for the rehabilitation of the paralyzed (CRP) uses sports for regaining their activity. Sports like boccia, dart throw, ring throw, bowling modified volleyball, etc used for the improvement of upper limb function. But mostly used sport is boccia. These games are selected by physiotherapists according to the patient's physical condition and muscle power of the upper limb. Repetition and duration were also designed by them.

I agree that this kind of sport helps to improve tetraplegic patients' upper limb function. But unfortunately, I didn't find any research in our country about the effect of upper limb sports for improving the hand function of tetraplegic spinal cord injured patients. For that reason, the effects are not clear to us. As I think it's effective so I want to clarify the effects and want to research that topic. I hope this study will give a piece of clear information about the effectiveness of sports on hand function and may help the physiotherapist to regain hand functions of tetraplegic patients, which will be beneficial for both the patient with tetraplegia and for developing the field of physiotherapy.

1.3.Aim and Objectives:

1.3.1. Aim of the study: The study aimed to investigate the Effectiveness of Modified Upper limb sports on hand function in Tetraplegic Spinal Cord Lesion Patients attended at CRP.

1.3.2. Objectives:

- To find out the socio-demographic information of the patient (Age, Sex, Occupation, Marital status, etc.)
- To elicit the effectiveness of upper limb sports on neurological recovery.
- To examine the impact of modified sports on functional activity.

1.4.Hypothesis:

1.4.1. Null hypothesis:

Modified Upper limb sports is no longer effective on hand function in Tetraplegic Spinal Cord Lesion Patient.

$H_{-0} = M_u = M_o \leq M_o$ where the difference of the primary and last pre-test and post-test means is similar.

1.4.2. Alternative Hypothesis:

Modified Upper limb sports are effective on hand function in Tetraplegic Spinal Cord Lesion Patient.

$H_{-1} = M_u \neq M_o > M_o$, where the difference of the primary and last pre-test and post-test means is not similar.

1.5Operational Definition:

Spinal Cord Injury:

SCI is a spinal injury that causes a temporary or permanent change in the cord's normal motor, sensory, or automatic function, resulting in neurologic deficiency and disability in patients. (Kirshblum & Waring 2014)

Tetraplegia:

According to Gomes-Osman (2017) "Tetraplegia is a condition that results from a cervical spinal cord injury and causes impairment or loss of sensory function and upper extremity control.

Boccia:

A game in which competitors in wheelchairs or stretchers aim to throw or roll balls as close to a target ball as possible.

Hand function:

Neurologic development, physiologic maturation, and functional development of learned movement and motor control patterns all contribute to hand function. The hand's ability to acquire great levels of expertise is due to the evolution of cerebral mechanisms in humans.

CHAPTER-II LITERATURE REVIEW

Traumatic or non-traumatic spinal cord damage is a sudden, overpowering, and enervating neurological disorder that has been addressed throughout history (Rahman et al., 2017). The overall accident rate for SCI is estimated to be 23 incidences per million globally. People over the age of 653 are the most vulnerable in affluent countries with aging populations (Tweedy et al., 2017). Internationally SCI is most common in men between the ages of 18 and 32 years old, however, it can also occur in people over the age of 65 in densely populated countries (Lee et al., 2014).

According to another study, 80 percent of all spinal cord-inured people in the area are young men between the ages of 15 and 35 (Popa et al., 2010). Globally SCI is one of the imperative health issues and among all the traumatic happenings it is the utmost overwhelming condition, where a yearly prevalence of 15 to 52.5 in every million people (Ackery et al., 2004). SCI is a critical health concern worldwide, and among all traumatic events, it is the most overwhelming ailment, with a yearly prevalence of 15 to 52.5 in every million people (Popa et al., 2010)

The front and posterior sections of the spinal cord are flattened, giving it a cylindrical appearance (Back, 2006). It starts in the foramen magnum of the skull and ends in the medulla oblongata of the brain. It ends inferiorly at the level of the first lumber vertebra's lower border. The spinal cord is located within the vertebral foramen, also known as the vertebral canal (Snell, 2010)

Traumatic spinal cord injury (TSCI) is one of the most serious injuries (Ning et al., 2012). The functioning of the physiological systems is dramatically affected by spinal cord damage (Tweedy et al., 2017). It results in paralysis, sensory loss, and bladder/bowel dysfunction in variable degrees (Ning et al., 2012). TSCI has far-reaching consequences that go beyond an individual's health; it also places a significant financial burden on families and society as a whole (Pickelsimer et al., 2010). Because Traumatic spinal cord injury has no treatment, prevention is essential. Implementing preventative measures and arranging healthcare treatments require a good understanding of epidemiology (Cripps et al., 2011). Most patients with spinal cord lesions in low-resource nations died within two years of sustaining a spinal

injury due to a lack of treatment (Momin, 2003). SCL is still a prominent cause of disability in Asia as well as Bangladesh (Islam et al., 2011)

Spinal cord injury can cause quadriplegia or paraplegia, which impairs the function of the limbs, trunk, pelvic organs, bladder, and intestine, as well as sexual function, depending on the degree of the damage (Kumar & Gupta, 2016). Use of the terms tetraplegia and paraplegia is discouraged because they represent incomplete lesions inexactly and wrongly indicate that tetraplegia and paraplegia should only be used for neurologically full injuries (Marino et al., 2003)

Tetraplegia is the loss or impairment of motor and sensory function in the cervical segment of the spinal cord caused by damage to the neural elements within the spinal canal. Tetraplegia impairs function by affecting the arm, as well as the trunk, leg, and pelvic organs. Injury to the brachial plexus or peripheral nerves outside the neural canal is not included (Kirshblum et al., 2011). Paraplegia is a condition in which a person's trunk or lower limbs are weak; as a result of their immobility, paraplegics' exercise capacity and working stroke volume are reduced (Tweedy et al., 2017).

SCI can potentially lead to a range of problems. Lack of skin sensation, pressure sores, bowel and bladder difficulties, pulmonary complications, autonomic dysreflexia, sexuality dysfunction, and other complications may occur in people with spinal cord injury (Somers, 2006). According to (Sinclair et al., 2006), Deep vein thrombosis, diminished vital capacity, osteoporosis, postural hypotension, spasticity, and heterotrophic ossification are some of the other problems.

"Physical fitness" is defined by Bucher as an individual's ability to live a healthy and balanced life (George et al., 2014). Physical fitness refers to cardiorespiratory fitness, body composition, elasticity, and muscular strength, which are all traditional characteristics that people have or may achieve, and are also linked to their ability to accomplish the activity of daily living (Tiu et al., 2017).

Two studies were found in which upper extremity disability in individuals with tetraplegia was evaluated in terms of the necessity of treatment or issues that needed to be addressed. In 1976, Hanson and Franklin investigated the significance of sexual function loss in people with SCI in comparison to three other deficits (snoek et al., 2000). Daily activities can place a lot of strain on a tetraplegic's upper extremity if they have a spinal cord injury (Valent et al., 2010). The upper limb's function is

critical for maintaining personal and social freedom (Federici et al., 2018). Daily exercise has been linked to several favorable outcomes in patients with spinal cord injuries, including improved cardiorespiratory fitness, improved muscle fitness, improved function, less effort during daily tasks, and a lower risk of secondary disorders (Barfield et al., 2010)

The primary purpose of all rehabilitation programs is to help people with SCI improve their quality of life (Kumar & Gupta, 2016). Physical activity levels improved throughout inpatient rehabilitation. However, shortly after leaving the rehabilitation center, the levels decrease sharply (Nooijen et al., 2012)

ADLs might be challenging for someone who has suffered a spinal cord injury. Individuals with SCI may be able to live independently in the community with or without full-time attendance after undergoing therapy. Individual and caregiver support and education are the focus of further interventions (Radomski and Latham, 2008). This includes assessing limb function to determine what the patient is capable of doing on his or her own, as well as imparting self-care skills to the patient (Ozelie et al., 2009). Sexual health and function, as well as other aspects of quality of life, are addressed (Atchison and Dirette, 2007)

Various medical specialty societies recommend exercise and athletic activity to maintain and preserve health, based on strong evidence from numerous single studies and meta-analyses (Scharhag et al., 2013)

CHAPTER-III METHODOLOGY

3.1.Study Design:

Quasi-experimental pre-test and post-test design types of quantitative research were selected to conduct this study. Kowalczyk (2017) defines pre-test post-test design as usually a quasi-experiment where participants are studied before and after the experimental manipulation. To complete this study the researcher chose a single group of participants and provided a pre-design intervention protocol during the experiment where no control group to compare with the experimental group. The basic premise behind the pretest-posttest design involves obtaining a pretest measure of the outcome to administer some treatment, followed by a post-test on the same measure after treatment.

Pre-test	Treatment	Post-test
O	X	O

The pre-test post-test design was valuable in describing what occurs after the introduction of the independent variable.

3.2. Study Setting:

From the SCI unit of CRP, Savar, Dhaka, the researcher collected data.

3.3.Study period:

Study period was 16th June to 16th September 2021

3.4. Study Population:

In this study, the People with tetraplegic Spinal Cord lesions who attended CRP from June 2021- September 2021 and who played Modified Upper limb sports at CRP were chosen as the sample population to conduct this study. For this study, about 20 people were selected.

3.5. Study sample:

In this study, the People with tetraplegic Spinal Cord lesions attended CRP and played modified upper limb sports and full fill inclusion criteria.

3.6. Sample size calculation:

Standard deviation calculation:

Count, N: 5

Sum, $\sum X$: 15

Mean, $\overline{X}$: 3

Variance, s^2: 2.5

Steps

$$S=\sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i-\bar{x})^2}$$

$$S^2=\frac{\sum(x_i-\bar{x})^2}{N-1}$$

$$=\frac{(1-3)^2+(2-3)^2+(3-3)^2+(4-3)^2+(5-3)^2}{5-1}$$

$$=\frac{10}{4}$$

$$=2.5$$

$$S=\sqrt{2.5}$$

$$=1.5811388300842$$

Sample size calculation:

$$n = \left(\frac{\left(\frac{2\alpha}{2}+\beta\right).Sd}{D}\right)^2$$ (Miot, 2011)

Here,

n = sample size

α = 1.96

β= .84

Sd=1.58

D =1

$$n = \left(\frac{\left(\frac{2\alpha}{2}+\beta\right).Sd}{D}\right)^2$$

$$= \left(\frac{(1.96+.84).1.58}{1}\right)^2$$

$$= \left(\frac{2.8\times1.58}{1}\right)^2$$

$$= \left(\frac{4.42}{1}\right)^2$$

= 19.5364

Here the actual sample size for this study was calculated 19.55. But as it was educational research. I took 20 SCI patients as the sample for making my calculation easier.

3.7. Inclusion criteria:

- Tetraplegia, also known as quadriplegia, is paralysis caused by illness or injury that results in the partial or total loss of use of all four limbs and torso; paraplegia is similar but does not affect the arms. The loss is usually sensory and motor, which means that both sensation and control are lost. Tetraparesis or quadriparesis, on the other hand, means muscle weakness affecting all four limbs. It may be flaccid or spastic. (ICD-10-CM Code G82.50)
- Tetraplegic spinal cord injury person who was attending at CRP.
- Age range 12-60 years. (According to Physiotherapist opinion less than 12 years and more than 60 years old people can't understand the therapist instructions)
- Both male and female(Kirshblum et al., 2011)
- People who were willing to participate in the study
- People who were playing boccia

3.8. Exclusion criteria:

- Paraplegic spinal cord injury patient
- A person who was suffering from a serious illness
- SCI patient with a severe head injury
- the person who was not suitable for upper limb sports.
- SCI patients who hada seizure disorder
- Outdoor service receiving patient

3.9. Data collection procedure:

For data collection face to face, the interview method was used. The materials such as -consent form, written questionnaire, pen, pencil, clip board, etc. were used for completing the interview session successfully and also to compose the valuable data from the patients.

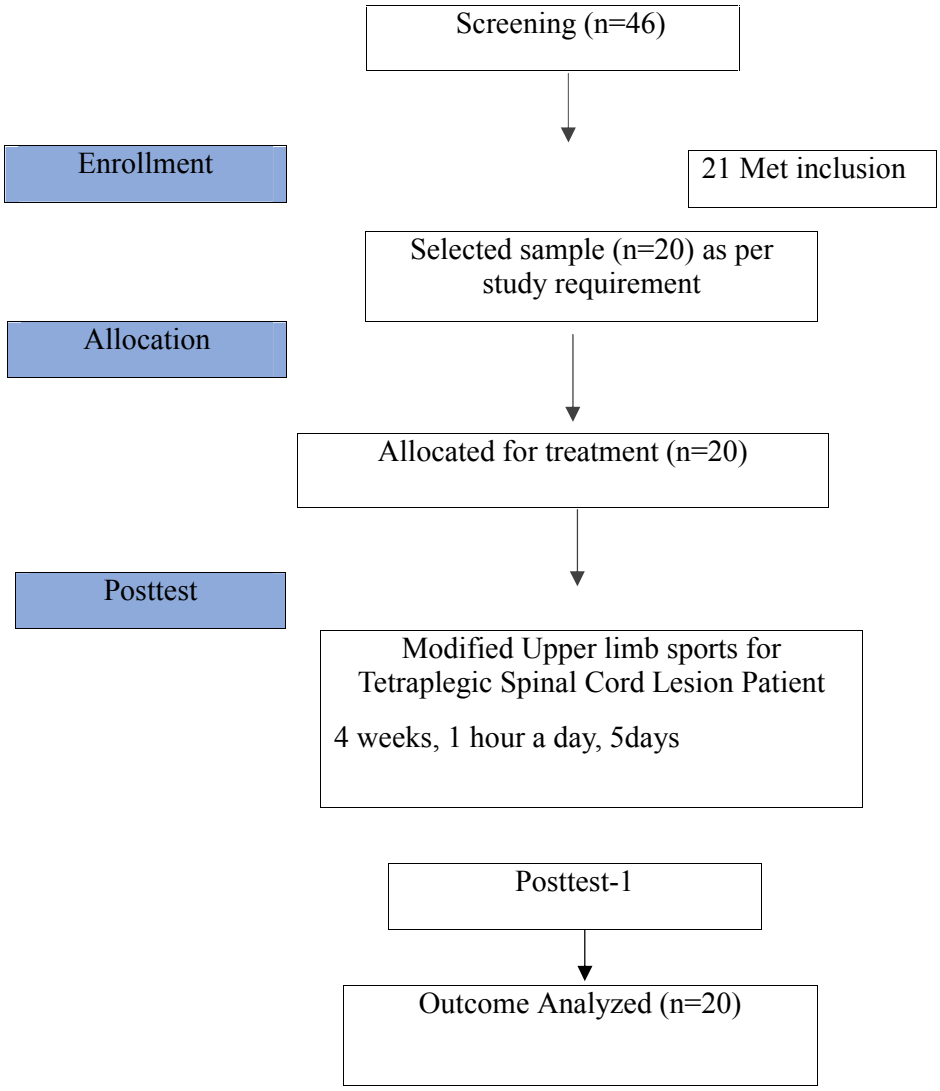
Through evaluating the patient, initial recording, intervention, and final recording, data collection had been conducted. A qualified physiotherapist assessed the patients at CRP in the SCI unit after the outdoor department screening. For every subject intervention was provided for 3 weeks.

According to inclusion criteria, the number of subjects was chosen for this data collection. Data will be collected by the researcher's formatted written questionnaire and it will gather through a pre-test, intervention, and post-test. For taking post-test at the end of 3 weeks of intervention, the same procedure will be performed.

To reduce the biasness, in front of the qualified physiotherapist the researcher collected data from the group. The data collector took a face-to-face interview after the quantitative investigation in a setting that was far from the treatment room by preset close-ended questionnaire and recorded the interview. For completing each question, it took approximately 20-30 minutes.

3.10. Conceptual Framework

CONSORT Flowchart:



3.11. Intervention:

Boccia has been a Paralympic sport since 1984, and it was created for athletes who have disabilities that affect movements, such as Cerebral Palsy, Muscular Dystrophy, or spinal injuries. Boccia is a recreational sport practiced by persons with a wide range of physical, sensory, and learning disabilities.

Boccia equipment:

- **Bocce Balls** – A bocce set consists of several balls known as "bocce balls." This ball has a diameter of about 4.2 inches. The balls are often red or green, but other colors may be available as well.

- **Pallino** – The pallino, which is sometimes referred to as a "jack," is a smaller ball that is used to represent the target for the bocce balls during game play.

Court setup:

To play bocce, you need a smooth, flat surface. This can be grass, sand, or turf. A regulation-size bocce court is 13 feet wide by 91 feet long and it is rectangular. But in CRP boccia is played usually in a circular shape. Tetraplegic patients made a circle whether sitting in a chair, wheel chair or a stretcher according to their condition. After making a circle there are also a foul lines—where players cannot pass when they throw. This line is drawn by using string, chalk, or even drawing a line in the sand to set these line-markings.

How to play:

In CRP usually, eight to fourteen even some times more patients play boccia each day. The number of bocce balls per player is determined by team size. Usually, they got one ball in each round and they don't play in a team, usually play individually. Each bocce game consists of a series of rounds called "frames," after which points are awarded.

- Randomly a player is selected to toss the pallino to set the target for the frame. The pallino must fall in the center.

- After throwing the pallino, the same player will bowl a bocce ball.

- During throwing player slightly lean forward, the shoulder in flexion position, elbow extended forearm supination, and wrist in extension position slightly.

- The goal of the toss is to get the bocce as close to the Pallino as possible Butcan't touch the Pallino.

- One by one every player will toss the bocce ball.

Fig 01: Boccia sports

- Usually, 4-5 frames are played, actually depends on the time. More than 5 frames can be played as it hasn’t any limitations.

- There will be a person who collects all the ball from the floor and again give them the ball after completing every frame.

- After a frame, the First, second, third will be counted according to the distance between the bocce and the pallino. Whose bocce will be closest to pallino he determine as the first. Most of the time this can be determined from sight alone, but you can also use a measuring tape for accuracy.

- Finally, the champion will be selected after the completion of all the frames. Which person will be identified as first most of the time than another one in all the frame, he will be the champion.

- Patients will participate in the sports program for three weeks, 5 days a week, and one hour per day.

Table 1: Treatment protocol for boccia sports

Variables	Values
Frequency	5 days in a week for 4 weeks
Intensity	1 hour/ day
Time	Once a day
Type of treatment	Sports activity

Fig 02: Boccia sports

Conventional therapy:

Along with sports patient takes conventional therapy also. Spinal cord injury has 4 phages. According to phase treatment procedure is different.

Acute stage: (6 weeks):

In the acute stage, respiratory complications and other complications which is associated with bed rest rapid arrival of paralysis are treated and prevented primarily. Others like pain management, range of motion, and strengthening exercise.

Assess the patient: first of all, a proper assessment should be done including subjective part, objective part, respiratory assessment, ASIA impairment scale to know about the patient condition and make a treatment plan.

Respiratory management: If an injury occurs above skeletal level D12 then the respiratory mechanism will be changed. In this stage, we can provide respiratory treatment like breathing relaxation, deep breathing, breath stacking, ACBT, Percussion and vibration, glossopharyngeal breathing, postural drainage, assisted coughing technique, and mechanical techniques such as nebulizer, incentive spirometry, suctioning, O2 supplementation.

Positioning: Positioning is important for the prevention of pressure sores, improving circulation, maintaining joint position, prevent muscle contracture.

Pain management: Proper positioning is very helpful to manage pain with the use of appropriate devices and support. We also give transverse friction massage, mobilization, hot and cold compression, and other physical agents such as IRR, UST, TENS, SWD, etc.

Tone management: slow stretching for spastic tone and fast stretching for flaccid tone, Rood approach.

To maintain Range of Motion: reduced ROM can cause contracture, hypertonicity, and spasticity. Treatment- passive stretching, positioning patient in a lengthening position, active, active assisted.

To maintain muscle strength: To strengthen a specific muscle-active movement, isometric, isokinetic, isotonic, weight-bearing exercise.

Patient and carer education: Educate about Spinal cord injury, pressure sore, urinary tract infection, posture, patient management, and associated secondary complication

Stabilization stage: (2-3 weeks)

To improve respiratory status: Deep breathing, ACBT, percussion and vibration, postural drainage, incentive spirometry, peak flow meter.

Pain management – positioning, DTFM, hot and cold compression, mobilization, and electrotherapy modalities.

To improve the Range of Motion both U/L and L/L: reduced ROM can cause contracture, hypertonicity, and spasticity. Treatment- passive stretching, positioning patient in a lengthening position, active, active assisted.

To improve muscle strength both U/L and L/L: exercise such as active, active resisted, isometric exercise, weight-bearing exercise, and therapeutic gymnasium equipment use, e.g- CPM, static cycle.

To improve bed mobility: rolling Rt-Lt, prone lying, bridging, lying to sitting practice.

To improve sitting balance: Both static and dynamic balance. Lifting on the bed.

Rehabilitation stage: (6-8 weeks)

Pain management –positioning, soft tissue release, DTFM, hot and cold compression, mobilization, and electrotherapy modalities.

According to the patient's neurological level encourage them for functional activity.

Tone management: slow stretching for spastic tone and fast stretching for flaccid tone, Rood approach.

To improve muscle strength both U/L and L/L: exercise such as active, active resisted, isometric exercise, weight-bearing exercise, and therapeutic gymnasium equipment use, e.g- CPM, static cycle.

To improve pelvic control: bridging, four-point kneeling, half kneeling, high kneeling, etc.

To improve bed mobility: rolling RT-LT, prone lying, bridging, lying to sitting practice.

Transferring: a bed to a wheelchair, wheelchair to bed.

To improve dynamic sitting balance: pelvic tilting, ball throw, reaching, balance exercise through medicine ball.

To improve functional ability: Activity of daily living- grooming, bathing, wearing dresses, bathing, toileting, taking food, etc.

To improve hand function: Strengthening of U/L. Mobilization of PIP, DIP, and wrist joint. Grasp and release different objects.

Standing practice: sit to stand, standing in the frame, single-leg standing, weight shifting Rt and Lt.
Sit to stand practice – like a floor or standing from a low level in addition to standing practice- both static and dynamic balance practice.
Gait re-education: weight shifting, single-leg standing, practice different parameters of stance and swing phase.
Hydrotherapy: who are suitable for this therapy.
Fitness activity and sports training.
Device selection: prescribe according to patient condition. Mobility aids as a wheelchair, low wheelchair, axillary crutch, elbow crutch, walking frame, sticks for walking, etc.

Re-integration stage: (2weeks)

Re-assess the patient

Educate the patient and the career about the benefits of home exercise.

Educate the patient about skin care, pressure sore, UTI, and other complication.

Examine the physical issues that occur and provide any appropriate device.

Monitor and evaluate mobility aids / adaptive equipment if necessary.

Encourage the patient to participate in a variety of social activities, such as a cultural event, an education class, both indoors and outdoors sports, and a film exhibition.

Encourage the patient to get involved in the community.

Inform the patient about the " Disability Card".

Some common complications occur during the treatment period:

Contracture

Decubitus ulcers

Pain

Heterotopic Ossification

Frozen shoulder

Contracture management: During this time, the most common and serious issue is the formation of joint contractures and stiffness. In roughly 66 percent of patients, a minimum of one joint contracture has been seen in the first year. Contracture can be prevented by ROM exercise and it also maintains functional capacity. In a flaccid period, ROM exercise should be done at least one time a day and in a spastic period, it should be done 2-3 times in a day.

Stretching and passive movement

Splint

Serial casting

Positioning

Decubitus ulcer management: The ischium, greater trochanter, sacrum, heel, malleolus, and occiput are all bone sites of the body where this can happen. Prevention is the best for a pressure sore. It can beprevented by changing position every 2 hourly in lying and lifting every half-hourly in sitting posture. Pressure sore treatments are:

To maintain the ulcer as aseptic or as least septic as possible, avoid contact with a hard surface, reduce moisture, and keep it as dry as possible.

Dressings made of hydrocolloids should be utilized. Septicemia is reduced when there is adequate antibiotic coverage.

Changing position every two hourly can lessen pressure on the area

Pressure dispersion cushions should be used

Protein intake

Avoid pressure on the wound area

If needed, surgical intervention can be done

Pain management: Pain is very common in spinal cord injury patients. positioning, soft tissue release, DTFM, hot and cold compression, mobilization, and electrotherapy modalities are mainly used to manage pain.

Heterotopic ossification management:

Pain management: NSAID, soft tissue release, TENS

ROM exercises such as PROM, AAROM, AROM

Strengthening exercise will help to preserve joint motion and also prevent muscle atrophy

Scar mobility

Frozen shoulder management:

AP,PA gliding

mobilization

Scapular stretching

Scapular rhythm

Pectoralis release

Pulley exercises

Ice, IRR

Neural stretching

Strengthening exercise of U/L

3.12. Outcome measurement tools:

The questionnaire consists of socio-demographic information-related questions (name, age, sex, occupation) and hand function-related questions. Hand function-related questions had chosen from 2 scales, which are Disabilities of the Arm, Shoulder, and Hand (DASH) and Spinal Cord Independence Measure scale.

I. The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) is used for the characterization of spinal cord injury (SCI). In the beginning, these scales were developed to classify the neurological deficit following a SCI, but currently, it uses as outcome measures for monitoring any change in SCI condition during natural recovery or treatments which is designed to encourage recovery of function (Vasquez et al., 2013).

II. Disabilities of Arm, Shoulder, and Hand (DASH) scale is used for whole upper extremity symptoms and functional assessment of the entire upper extremity. It can be used in all or multiple upper extremity disorders. It has a total of 30 items, among them 6 items for symptoms and 24 items about function. There are also 2 optional segments for work (4 items) and sports or performing arts, which are used infrequently in a patient setting, but moderately used for athletes and hand workers (Angst et al., 2011).

3.13. Statistical Test

3.13.1. Determination of the nature of data

The variables were determined as nominal, ordinal, interval, and ratio data and considered their parametric or non-parametric properties based on data type, normality test, and standard procedure. (Hicks, Research method for Clinical therapists)

Table –2: **Data category and normality test of data**

Variable	Description	Data type	Normality test	Data distribution
Age - Overall		Ratio	P= (.200), (.059)	Parametric
Age in category-	12-20 21-30 31-40 41-50 51-60	Ordinal		Nonparametric
Gender-	Male Female	Nominal		Nonparametric
Marital status-	Married Unmarried Divorced Widow Separated	Nominal		Nonparametric
Educational level-	No formal education Primary education Secondary education Higher secondary education Bachelor or above	Ordinal		Nonparametric
Occupation-	Car driver Student Labour Businessman Farmer Mason Service holder House wife Others	Nominal		Nonparametric
Family member-		Ratio	P= (.006), (.018)	Parametric
Residential area-	Rural Urban Semi-urban	Nominal		Nonparametric
Co-Morbidity-	DM HTN Heterotopic	Nominal		Nonparametric

	ossification Pressure sore Respiratory complication Postural hypotension Autonomic-dysreflexia Urinary tract - infection Contracture Bowel and Bladder dysfunction Others			
Earning member in the family-		Ratio	P=(.0001), (.0001)	Parametric
Family income-		Ratio	P= (.005), (.0001)	Parametric
Family income in the category-	(5000-10000) (11000-20000) (21000-30000) (31000-50000)	Ordinal		Nonparametric
Duration since incidence-		Ratio	P= (.001), (.0001)	Parametric
Duration since incidence in the category-	(1-10) (11-20) (21-30)	Ordinal		Nonparametric
Cause of injury-	**Traumatic** RTA Fall from height Fall of overloading Shallow diving Motor vehicle accident Motor cycle accident Pedestrian-vehicle crashes Bicycle accident Gunshot injury Bomb blast injury Others **Non-traumatic** Transverse myelitis Inflammation of spinal cord Pott's disease Others	Nominal		Nonparametric
Pre sensory total-		Interval	P= (.115), (.053)	Parametric
Post sensory		Interval	P= (.026), (.003)	Parametric

total				
Pre motor total-		Interval	P= (.005), (.003)	Parametric
Post motor total		Interval	P= (.005), (.001)	Parametric
Neurological level-	C1 C2 C3 C4 C5 C6 C7 C8	Nominal		Nonparametric
ISNCSCI Diagnosis-	Complete-A Incomplete-B Incomplete-C Incomplete-D	Nominal		Nonparametric
Pre-test DASH score percentage-		Interval	P= (.200), (.508)	Parametric
Post-test DASH score percentage-		Interval	P= (.200), (.562)	Parametric

3.13.2. Determination of statistical test

The statistical has been performed as descriptive and inferential statistics based on parametric or non-parametric properties. The descriptive statics was performed as frequency and percentage in nominal or ordinal data. Mean and standard deviation has been calculated for interval or ratio data.

The inferential statistics has been performed as follows

Table-3: Inferential statistical test

Purpose	Variables	Statistical test
Mean difference between Pre-test and Post-test	Independent variable as parametric	Paired t-test
	Independent variable as nonparametric	Willcoxon test

(Hicks, 1999)

3.14. Ethical consideration:

The research proposal was submitted for approval to the institution of Review Board (IRB) of Bangladesh Health Professions Institute (BHPI) and after the defense, the research proposal approval was taken from the IRB. A written/ verbal consent was taken from the participant before collecting data. The World Health Organization (WHO) and Bangladesh Medical Research Council (BMRC) guideline was followed to conduct the study. Again before beginning the data collection, the researcher was obtained permission from the concerned authorities to ensure the safety of the participants. To eliminate ethical claims, the participants were set free to receive treatment for other purposes as usual. Each participant was informed about the study before beginning and given written consent.

CHAPTER-IV RESULTS

4.1. Socio-demographic information of the patient's

My research objects were spinal cord lesion patients. I screened 46 patients and among them, 20 patients met the inclusion criteria. Table-4 shows the socio-demographic information of the patients.

Table-4: Socio-demographic information

Variable	Category	Value
Age - **Overall**	Ratio	29.40± 11.66
Age in category- **(12-20)** **(21-30)** **(31-40)** **(41-50)** **(51-60)**	Ordinal	6(30%) 7(35%) 3(15%) 4(20%) 0
Gender- Male Female	Nominal	19(95%) 1(5%)
Marital status- Married Unmarried Divorced Widow Separated	Nominal	12(60%) 8(40%) 0 0 0
Educational level- No formal education Primary education Secondary education Higher secondary education Bachelor or above	Ordinal	 3(15%) 5(25%) 9(45%) 2(10%) 1(5%)
Occupation- Car driver Student Labour	Nominal	 2(10%) 5(25%) 4(20%)

Businessman Farmer Mason Service holder House wife Others		2(10%) 4(20%) 0 2(10%) 0 1(5%)
Family member-	Ratio	5.35± 1.66
Residential area- Rural Urban Semi-urban	Nominal	 14(70%) 6 (30%) 0
Co-Morbidity- DM HTN Heterotopic ossification Pressure sore Respiratory complication Postural hypotension Autonomic dysreflexia Urinary tract infection Contracture Bowel and Bladder dysfunction Others	Nominal	0 0 0 4(20%) 4(20%) 0 0 0 0 12(60%) 0
Earning member in the family-	Ratio	1.55± .83
Family income-	Ratio	16200± 13165
Family income in the category- (5000-10000) (11000-20000) (21000-30000) (31000-50000)	Ordinal	 11(55%) 5(25%) 2(10%) 2(10%)

Male was predominantly higher than female. Out of 20 participants, Male were19(95%), and females were 1(5%). The mean age of the population was 29.40± 11.66 years. Participants' ages ranged from 12 years to 60 years. Among them, 30%(n=6) were in the age group between the range of 12-20 years. Also, 35% (n=7) of the respondents were found in the age group between 21-30 years,15% (n=3) of them were in the age group between 31-40 years and 20%(n=4) were in the age group between 41-50. The researcher found that the married population is higher than the unmarried population. Married person was 60% (n=12) and unmarried person was 40% (n=8). Most of the participants were secondary level 45% (n=9) which means

have the outstanding knowledge to read and write. After that primary level was the second most common and the number was 25% (n=5). No formal education was 15%(n=3), Higher secondary education was 10% (n=2) and Bachelor's or above was only 5% (n=1). The table shows that the number of students is more than another profession. 10% (n=2) are car driver, 25% (n=5) are student, 20% (n=4) are day labor, 10% (n=2) are businessman, 20% (n=4) are farmer, 10% (n=2) are service holder and 5%(n=1) are others. Participants' mean family member was 5.35± 1.66. Most of the respondents who are suffering from spinal cord injury were from rural areas. Only 30% (n=6) were from urban areas and the rest of them were from rural areas 70% (n=14). Most of the patients are suffering from bowel and bladder dysfunction 60% (n=12), from a pressure sore are 20%(n=4) and the rest of them are from respiratory complications 20%(n=4). Respondent's mean earning family members was 1.55± .83. Most of the participants were from the low economic condition. 55%(n=11) persons were from family income range between (5000-10000), 25%(n=5) persons from range between (11000-20000), 10%(n=5) persons from (21000-30000). Only 10%(n=2) persons from the higher economic condition.

4.2. SCI related information of the patient's

Table-5: SCI related information

Duration since incidence-	Ratio	6.75 ± 4.867
Duration since incidence in the category- **(1-10)** **(11-20)** **(21-30)**	Ordinal	 16(80%) 3(15%) 1(5%)
Cause of injury- **Traumatic** RTA Fall from height Fall of overloading Shallow diving Motor vehicle accident Motor cycle accident Pedestrian-vehicle crashes Bicycle accident Gunshot injury	Nominal	 4(20%) 8(40%) 3(15%) 4(20%) 0 1(5%) 0 0 0 0

Bomb blast injury Others **Non-traumatic** Transverse myelitis Inflammation of spinal cord Pott's disease Others		0 0 0 0 0 0
Sensory total-	Interval	60.55± 36.67
Post sensory total	Interval	87.10± 67.425
Motor total-	Interval	22.4± 22.058
Post motor total	Interval	34.80± 31.502
Neurological level-	Nominal	C1- 1(5%) C2- 4(20%) C3- 2(10%) C4- 10(50%) C5- 2(10%) C6- 1(5%) C7-0 C8-0
ISNCSCI Diagnosis- Complete-A Incomplete-B Incomplete-C Incomplete-D	Nominal	 10(50%) 3(15%) 4(20%) 3(15%)

Populations mean duration incidence since was 6.75 ± 4.867. Between 1-10 months duration since incidence range group participants are 80%(n=16), which is higher than other groups. 15%(n=3) are from the 11-20 range group and only 5%(n=1) are from the 21-30 months range group. Among 20 participants, most of them were injured by fall from height 40% (n=8), 20%(n=4) persons by a road traffic accident, 20%(n=4) are by shallow water diving, 15%(n=3) by fall of over loading 5%(n=1) person by motor cycle accident. Participants' total sensory and total motor score mean was 60.55± 36.67 and 22.4±22.058. C4 neurological level is most common among the total participants.50%(n=10) patients are from C4 neurological level, 5%(n=1) are is from C1, 20%(n=4) are from C2, 10%(n=2) are from C3,10%(n=2) are from C5 and 5%(n=1) is from C6 level. According to ISNCSCI diagnosis 50%(n=10) patients were Complete-A, 15%(N=3) are incomplete-B, 20%(n=4) were Incomplete-C and 15%(N=3) were Incomplete-D patient.

4.3. Changes in sensory score

Paired t-test has been determined to measure the changes between pretest and posttest followed by sports interventions.

Table-6

Mean difference	**SD of mean difference**	**95% confidence interval of the difference**		**df**	**t**	**P-value**
-26.550	39.717	Lower	upper	19	-2.990	.008**
		-45.138	-7.962			

****Level of significance (<.01)**

Interpreting the results,

The result has an associated probability of less than .01, which means that the changes of random error accounting for the outcome of this experiment are less than 1 in 100. Because the usual cut-off point for claiming that the result is significant is 1%. We can conclude that our result is significant, at less than the 1% level.

Sensory score comparison using Wilcoxon Signed Rank test within the trail group:

Rank and test statistics of patient-rated sensory score within the trial group

Table-7

Case numbers	**Pre-test score**	**Post-test score**	**Change score**	**Wilcoxon**	
1	138	153	15	**Z**	**P-value**
2	08	11	03		
3	73	212	139		
4	27	29	02		
5	84	127	43		
6	29	32	03		
7	32	34	02		
8	117	142	25		
9	47	51	04		
10	34	38	04		
11	113	223	110	**-3.923**	**.0001**
12	43	48	05		
13	121	213	92		
14	71	87	16		
15	55	81	26		
16	37	43	06		
17	49	52	03		
18	63	75	12		
19	26	31	05		
20	44	60	16		

The table-7 describes the comparison of the participants before (pre-test) and after the (post-test) sensory score. The table shows that in the trial group patient have an increase in sensory score after taking sports intervention along with conventional therapy. 20 participants of the trial group had lower sensory scores before the intervention and the score increased after sports intervention along with therapeutic intervention.

By examining the final test statistics portion of the table by Wilcoxon signed-rank test it was discovered that, after 3 weeks of the sports intervention course, it shows a statistically significant change in the score of the sensory total score (Z= -3.923, p= .0001). Therefore, it can be said that sports intervention along with conventional physiotherapy can improve the sensory score of spinal cord lesion patients.

4.4. Changes in the motor score:

Paired t-test has been determined to measure the changes between pretest and posttest followed by sports interventions.

Table-8

Mean difference	SD of mean difference	95% confidence interval of the difference		df	t	P-value
-12.400	17.089	Lower	upper	19	-3.245	.004**
		-20.398	-4.402			

****Level of significance (<.01)**

Effect on total motor score has been elicited by measurement of the motor score before and after sports activity and statistically tested through paired t-test. The motor score measurement had a statistically significant result revealing changes between pre and post-test. Table 4 shows the effect on motor score due to physical activity. The mean was -12.400 with a standard deviation of 17.089, 95% CI where upper limit -4.402 and lower limit -20.398, the significant value found .004. That means the null hypothesis has been rejected and the alternative hypothesis accepted. Sports interventions have a highly significant (<.01) impact on the motor score in the person with spinal cord injury.

Motor score comparison using Wilcoxon Signed Rank test within the trail group: Rank and test statistics of patient-rated motor score within the trial group

Table-9

Case numbers	Pre-test score	Post-test score	Change score	Wilcoxon	
1	60	70	10	**Z**	**P-value**
2	00	05	05		
3	11	85	74		
4	13	14	01		
5	73	92	19		
6	02	04	02		
7	13	18	05		
8	26	40	14		
9	20	26	06		
10	03	06	03		
11	64	92	28	**-3.924**	**.0001**
12	12	16	04		
13	50	86	36		
14	03	14	11		
15	23	32	09		
16	13	17	04		
17	14	17	03		
18	22	28	06		
19	00	04	04		
20	26	30	04		

This Table described the comparison of the participants before (pretest) and after (post-test) motor score. The table's legend displayed that the trial group have an increase in motor score after sports intervention along with physiotherapeutic intervention (conventional physiotherapy) is given to them. 20 participants of the trial group had a lower score before the intervention and the score increased after the application of the intervention of the sports along with physiotherapeutic intervention (conventional physiotherapy). In addition, no participant has experienced a decrease in motor score after the treatment session in the group and also indicates that no patient's motor score

remained the same as the pretest score. P-value is 0.0001 which indicates that there is less than a 0.1% chance that the results are due to random error and it is significant.

4.5. Changes in hand function

Paired t-test has been determined to measure the changes between pretest and posttest followed by sports interventions.

Table-10:

Mean difference	**SD of mean difference**	**95% confidence interval of the difference**		**df**	**t**	**P-value**
10.13	5.54	**Lower**	**upper**	19	8.18	.0001***
		7.53	12.72			

*****Level of significance (<.001)**

Interpreting the results,

The result has an associated probability of less than .001, which means that the changes of random error accounting for the outcome of this experiment are less than 1 in 10. Because the usual cut-off point for claiming that the result is significant is 0.1%. We can conclude that our result is significant, at less than the 0.1% level.

Disability comparison using Wilcoxon Signed Rank test within the trail group:

Rank and test statistics of patient-rated disability within the trial group

Table-11

Case numbers	**Pre-test score**	**Post-test score**	**Change score**	**Wilcoxon**	
1	41.67	30.83	10.84	**Z**	**P-value**
2	87.50	84.17	3.33		
3	44.17	30.83	13.34		
4	67.50	55.00	12.5		
5	77.50	61.67	15.83		
6	85.83	79.17	6.66		
7	87.50	64.17	23.33		
8	65.00	50.83	14.17		
9	73.33	56.67	16.66		
10	92.50	86.67	5.83		
11	65.00	51.67	13.33	**-3.921**	**.0001**
12	70.83	56.67	14.16		
13	51.67	41.67	10		
14	82.50	81.67	.83		
15	65.83	53.33	12.5		
16	75.83	71.67	4.16		
17	74.17	70.00	4.17		
18	51.67	45.00	6.67		
19	80.00	74.17	5.83		
20	60.00	51.67	8.33		

This Table described the comparison of the participants before (pretest) and after (post-test) disability score. The table's legend displayed that in the trial group no increase of disability after sports intervention along with physiotherapeutic intervention (conventional physiotherapy) is given to them.20 participants of the trial group had a higher score before the intervention and the disability score reduced after the application of the intervention of the sports along with physiotherapeutic intervention .In addition, no participant has experienced an increase in disability after the treatment session in the group and also indicates that no patient's disability score remained the same as the pretest score. P-value is 0.0001 which indicates that there is less than a .1% chance that the results are due to random error and it is significant.

CHAPTER -V DISCUSSION

The purpose of the study was to investigate the Effectiveness of Modified Upper limb sports on hand function in Tetraplegic Spinal Cord Lesion Patients and the objectives were to identify the socio-demographic information of the patient (Age, Sex, Occupation, Marital status, etc.) to elicit the effectiveness of upper limb sports on the motor score and to examine the impact of modified sports for functional activity.

To demonstrate improvement, 20 traumatic paraplegic SCI people were randomly assigned to a single group in this experimental investigation. Every person with a traumatic history who visited the Centre for the Rehabilitation of the Paralyzed between June 20, 2021, and September 20, 2021, was examined for eligibility criteria, and 21 people met the criterion for participation. One patient out of twenty-one did not complete the scheduled session. The pretest, sports intervention, and posttest were completed by 20 responders for quantitative analysis. A systematic questionnaire was used to assess the outcome. The researcher found a significant improvement in hand function, total motor score, and total sensory score.

Age, gender, marital status, educational status, and occupation were taken to consideration as demographic variables. In this study age range of the participants were 12-60 years and there was 5 group of age range among them the age range between 21-30 years, which showed a maximum number of 7 participants (35%). In my study, participants' mean age was 29.40 years with a standard deviation ± 11.66 which is partially similar to the study of Islam et al. (2011).

Male and female participants were in this study. Male was predominantly higher than female. Among 20 participants 95% (n=19) were male and only 5%(n=1) was female patient. In the study of Nwankwo & Uche (2013) male-female ratio was 4.3:1 which means there were also higher male participants than females and this was the similarity between the two studies. In this study, I also found that married 12(60%) patients are slightly higher than unmarried and Islam et al. (2011) also supported that. Out of 20 patients, 70% of patients were from the village and only 30% were from urban. In another study, also found that 60–70% were illiterate, poor, and living in villages which is similar to my study. The current study differed from the previously

published study in that it was a quasi-experimental study, whereas the previously published study was a cross-sectional study (Islam et al., 2011).

The study of Ramakrishna et al. (2011) showed that a total of 3 persons (3.6%) had no formal education and there were only 8 persons (9.6%) with college or university level education. On the other hand, my study also shows that 3 participants (15%) had no formal education and 12 participants (60%) had school, college, or university level education. According to a Brazilian study, 38 (63.3%) of the 60 patients had completed or incomplete basic school, 19 (31.7%) had completed or incomplete secondary education, and 3 (5%) had completed or incomplete college education (Blanes et al., 2009).

In the study study among 20 participants, 10% (n=2) are car driver, 25% (n=5) are student, 20% (n=4) are day labor, 10% (n=2) are businessman, 20% (n=4) are farmer, 10% (n=2) are service holder and 5%(n=1) are others. Other study showed that 17 were businessmen (20%), 17 students (20%), 12 civil servants (14.0%), 12 artisans (14.0%) ,11 farmers (12.9%), 8 drivers (9.4%), 6 military/ police (7.1%), 1 calergy (1.8%) and 1 Toddler (1.8%). Two of this study showed that student and businessman are more prone to spinal cord injury (Nwankwo & Uche, 2013).

In the case of the financial status of the participants, most of the participants were from the low economic condition. 55%(n=11) persons were from family income range between (5000-10000), 25%(n=5) persons from range between (11000-20000), 10%(n=5) persons from (21000-30000). Only 10%(n=2) persons from higher economic conditions and participant's mean family members were 1.55 with a standard deviation ± .83. Razzak(2013) also found a similar result. In his study among 56 patients 55.4% (n=31) were from less than 50000 TK monthly income, 18(32.1%) were from 5000-10000TK range and only 12.5% (n= 7) patients from more than 10000TK monthly income.

Now should focus on the SCI-related information of the patient. Co-morbidity, duration since incidence, cause of injury, neurological level, and ISNCSCI Diagnosis are SCI-related information. The causes of the injury of this research participants were mainly traumatic. In the other research, among 35 patients traumatic patients found only 4(11%) and non-traumatic patients were 31(89%) which was a contrast from my study (Itzkovich et al., 2018). This study showed that among 20 participants,

most of them were injured by fall from height 40% (n=8), 20%(n=4) persons by a road traffic accident, 20%(n=4) are by shallow water diving, 15%(n=3) by fall of over loading 5%(n=1) person by motor cycle accident. On the other hand, another study stated that among 85 persons 47(55.3%) persons were injured by road traffic accidents, and 20(23.5%) persons were injured by falls which were also unsimilar with my study (Nwankwo & Uche, 2013). But in the study of Razzak et al.(2013), it was stated that fall from height was the main cause of injury and the second most common cause was road traffic accident. That is similar to my findings.

This study found that most of the patients are suffering from bowel and bladder dysfunction 60% (n=12), from a pressure sore are 20%(n=4) and the rest of them are from respiratory complications 20%(n=4). According to a study conducted in the Netherlands, 49% of people had a urinary tract infection (UTI) and 36% had a pressure ulcer. (Haisma et al., 2007). Urinary infection (88.3%), muscular spasm (65%), and pressure ulcers were the most prevalent consequences of SCI, according to another study. (26.7%) (Blanes, 2009). Urinary tract infections (62%), spasticity (57%), and pressure ulcers have all been observed in a small number of trials (30%) (Rouleau et al., 2011).

In this recent study, duration since incidence mean was 6.75 with standard deviation ± 4.867 years and there was 3 group of duration range among them the range between the (1-10) months participants were higher 80%(n=16), 15%(n=3) are from 11-20 duration range group and only 5%(n=1) are from 21-30 months range group. According to a study which is conducted in Iran, among 106 patients only 8.4% (9) participants duration since incidence was less than 1 year and higher participants were between 3.1-5 years duration (Moghimian et al., 2015)

C4 neurological level is most common among the total participants in the recent study. 50%(n=10) patients are from C4 neurological level, 5%(n=1) are is from C1, 20%(n=4) are from C2, 10%(n=2) are from C3,10%(n=2) are from C5 and 5%(n=1) is from C6 level. The study of Razzak, (2013) also found that C4 is the most common neurological level among the SCI patient. In his study 2 person had been injured at the C3 level, 10 persons in C4 level, 7 persons in C5 level, 3 people had an injury in C6, and 1 person in C7 neurological level.

In this study 10(50%) were complete-A, 3(15%) were incomplete-B; 4(20%) were incomplete-C, 3(15%) were incomplete-D. A study in Gaza showed that 40(49.4%) had Complete-A, 1(1.2%) had incomplete-B, 4(4.9%) had incomplete-C, 4(4.9%) had incomplete-D (Zeyada, 2009).

In total sensory score pre-test mean was 60.55 and the post-test mean was 87.10 and mean difference of the pre-test post-test was -26.550. Paired t-test value on SPSS was .008 for the total sensory score. This indicates that there was a significant difference between the pre-test and post-test total sensory scores. I also did the Wilcoxon test which value was .0001. This also indicates that there were highly significant changes between pre-test and post-test. In another study, there also stated that there were significant changes occurred in sensory scores after intervention (Harvey et al., 2016)

The motor total score had been demonstrated in this study by pre-test and post-test and also by Wilcoxon test. In a previous study, they also measured motor scores by the Wilcoxon test. In this study, the mean of the total motor score pre-test was 22.4 and the post-test mean was 34.80 and the mean difference was -12.400. 0n SPSS paired t-test value was .004 for the motor score. And the Wilcoxon test value was .0001. That means there were significant changes between the pre-test and post-test total motor scores. Harvey et al. (2016) also found the same result.

In this study, the DASH score was measured through pre and post-test where the DASH score pre-test mean was 70 and the post-test mean was 59.87. The mean difference between pre-test and post-test was 10.13. Paired t-test value was .0001 and the value of Wilcoxon test was also .0001 which indicates that the changes between pre-test and post-test were significant. Another experimental study by Harvey et al. (2016) also stated that there was a significant difference between pre-test and post-test.

Limitation of the study

As it was the first study in Bangladesh, there were various limitations and obstacles to overcome when performing the research. Because there were only 20 participants in this study, the external validity of the investigation was reduced, and there may have been disagreement about the distribution of confounding characteristics such as economic status, age, duration since incidence, and Disability score. In this study, the participants get only 4 weeks of treatment sessions due to lack of time limitation. However, while the treatment was beneficial, it was unable to determine the long-term effects. As this research had no control group it's hard to tell that actually, the intervention was beneficial for the patients. Though the study was intended to be a Randomized Control Trial, however, it was not carried out due to a lack of patients and a lack of time. In Bangladesh, this type of relevant study is not available, therefore research-related information is limited. An undergraduate student completed the research study, which was her first research project. As a result, the researcher had little practical experience with research procedures and strategies.

CHAPTER-VI CONCLUSION AND RECOMMENDATION

6.1. Conclusion

One of the most catastrophic injuries in human life is a spinal cord lesion. Every year, millions of people suffer from spinal cord injuries. There is a lack of evidence and a reliable database about spinal cord lesions in Bangladesh. In Bangladesh, there is no estimate of the number of people who have spinal cord injuries. Bangladesh is a country in the process of evolving. The majority of them have a low socioeconomic status and a weak educational background. There is also a lack of awareness in this country about injuries, particularly those caused by spinal cord lesions. In Bangladesh, a high proportion of SCI was caused by traumatic factors that could have been avoided. The total number of respondents in this survey was 20, with 19 (95%) males and 1 (5%) females. As a result, males are more vulnerable than females. The study concluded that the most vulnerable age group was 21-30 years old, as well as people with lower levels of education. The study also discovered that bowel and bladder dysfunction, pressure sores, and respiratory complications were the most common complications that develop in SCI patients.The study used a quasi-experimental single group pre-test and post-test design to look at how to hand function improved following a sports intervention, and the results showed that the difference was significant. Because of their poor hand function, most people with tetraplegic SCI were dependent on their caregivers. The improvement in the hand function of persons with tetraplegic spinal cord injuries was improved by sports. Physiotherapy plays a significant role in their recovery as well.

The purpose of this study is to investigate the effectiveness of sports therapy among tetraplegic patients with Spinal Cord Injury, which will aid in their rehabilitation, functional activities, and overall quality of life.

From this research, the researcher concluded the specific variables and comparison of their improvement. This will aid the professionals to decide the specific and effective treatment protocol for tetraplegic SCI patients.

6.2. Recommendation

For people with SCI, physiotherapists should take on a broader role and use holistic treatment strategies. This is an area where physiotherapists need to polish up their knowledge. Patients should be involved in treatment by physiotherapists to reduce hand function problems. Physiotherapists should focus on this issue more during the treatment period. It would be insignificant if the physiotherapists did not involve the patients in their treatment.For this reason, it is necessary to involve the patients in sports programs, etc.

Despite the study's limitations, the investigators suggested some further steps that may be taken to improve the success of future research. This is an area where we need to perform additional investigation. A true experimental study would provide a definite outcome regarding their hand function. Because the study was brief, it will be conducted over a longer period in the future. The male and female participant ratios were not equal; therefore, for the correctness of the results, the male and female respondent ratios should be maintained in the future.

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সম্মতি পত্র

আসসালামু আলাইকুম,

আমি সুলতানা ইয়াসমিন। আমার কোর্স কারিকুলাম সম্পন্ন করার জন্য আমাকে এই গবেষণা সম্পন্ন করতে হবে এবং আমার গবেষণার শিরোনাম **"মেরুরজ্জুতে আঘাত প্রাপ্ত টেট্রাপ্লেজিক রোগীদের হ্যান্ড ফাংশনে মডিফাইড আপার লিম্ব স্পোর্টস এর কার্যকারি "** আমার গবেষণাটি সম্পন্ন করার জন্য আমার কিছু সামাজিক, জনসংখ্যা বিষয়ক এবং ক্লিনিক্যাল তথ্য জানা প্রয়োজন। সুতরাং আমি আপনাকে কিছু প্রশ্ন এবং পরীক্ষা করতে চাই এই বিষয়ে এবং এর জন্য মোটামু ৩০ মিনিট এর মতো সময় লাগবে।

আমি আপনাকে আশ্বস্ত করছি যে এটা একটি পেশাদার গবেষণা এবং এতে আপনার কোনো ক্ষতি হবেনা। আপনার দেয়া তথ্যগুলো গোপন রাখা হবে এবং কোনো প্রতিবেদন অথবা প্রকাশনায় তথ্যটি নামবিহীন থাকবে। আপনার অবগতির জন্য জানাতে চাই যে এই গবেষনায় আপনার অংশগ্রহণ সম্পূর্ণ স্বেচ্ছাকৃত এবং এখানে কোনো আর্থিক লেনদেন জরিত থাকবে না।

গবেষণার অংশ হিসেবে অথবা অংশগ্রহণকারীর অধিকার হিসেবে আপনি নিজেকে যেকোনো সময় গবেষণা থেকে প্রত্যাহার করতে পারবেন অথবা চাইলে যেকোনো প্রশ্ন বাদ দিয়ে অগ্রসর হতে পারবেন। আপনার যদি এই বিষয়ে আরো কোনো প্রশ্ন থেকে থাকে অনুগ্রহ করে গবেষক সুলতানা ইয়াসমিন (৪র্থ বর্ষ, ফিজিওথেরাপি বিভাগ- বিএইচপিআই,সিআরপি, সাভার, ঢাকা-১৩৩৪)-কে অথবা আমার গবেষণার সুপারভাইজর কাজী মোঃ এমরান হোসাইন স্যার (প্রভ , ফিজিওথেরাপি বিভাগ- বিএইচপিআই, সিআরপি, সাভার, ঢাকা-১৩৩৪) কে নির্দ্বিধায় জিজ্ঞেস করতে পারেন (০১৭৩৫৬৬১৪৯২)

আমি কি সাক্ষাৎকার শুরু করতে পারি (টিক চিহ্ন দিন)

অংশগ্রহণকারীর সাক্ষর	তারিখঃ
উপাত্তসংগ্রহকারীর স	তারিখঃ
সাক্ষীর সাক্ষর	তারিখঃ

Code No:

Informed Consent

Greetings!

My name is Sultana Yasmin. I am conducting this study which is the part of my course curriculum and my thesis title is **"Effectiveness of Modified Upper limb sports on hand function in Tetraplegic Spinal Cord Injury Patients"**. For the fulfillment of my study, I would like to know some information about social, demographics, clinical information set people. So, I need to ask you some questions and examine you on this regard and this will take approximately 30 minutes.

I am assuring you that this is a pure professional study and this will not creating any harm to you. The information you will provide, will be treated as confidential and in event of any report or publication the source of these information will be kept as anonymous. I would like to inform you that your participation of this study will be considered as voluntary and there will not be any kinds of financial dealings.

As a part of this study or by the rights of the participants you can withdraw yourself at any time from this study or if you will want to skip any questions that you don't want to give answer, you can proceed. If you further have any questions on this study, please feel free to ask researcher Sultana Yasmin, 4th year student, Physiotherapy Department, Bangladesh Health Professions Institute(BHPI), CRP, Savar, Dhaka-1343 or my research supervisor Kazi Md. Amran Hossain, Lecturer of Physiotherapy, BHPI, CRP, Savar, Dhaka-1343. (01735661492)

May I start the interview? (Put tick mark)

Yes	No

Signature of the Participant's: Date:

Signature of Interviewer: Date:

Signature of Witness: Date:

English questionnaire:

Title: Effect of Modified Upper limb sports on hand function in Tetraplegic Spinal Cord Injury Patient

Part - 1: Participant's identification

1.1	Participants Identification No:
1.2	Date:
1.3	Participant's Name :
1.4	Address : Village/ Street No: Post-office: Thana: District:

Part – 2: Socio-demographic Information

NO.	Questions	Variables	Answers
2.1	Age (Write)		
2.2	Gender (Write answer number)	1.Male 2. Female	
2.3	Marital status (Write answer number)	1. Married 2. Single 3. Divorced 4. Widow 5.Seperated	
2.4	Educational level (Write answer number)	1. No formal education 2.Primary education 3.Secondary education 4.Higher secondary 5.Bachelor or above	

2.5	Occupation (Write answer number)	1.Car driver 2.Student 3.Labour 4.Businessman 5.Farmer 6.Mason 7.Service holder 8.Housewife 9.Others (Please mention)	
2.6	Family member:(Write)		
2.7	Residential area (Write answer number)	1. Rural 2. Urban 3. Semi-urban	
2.8	Co-Morbidity (Write answer number)	1. DM 2. HTN 3. Heterotopic ossification 4. Pressure sore 5. Respiratory complication 6. Postural hypotension 7. Autonomic dysreflectia 8. Urinary tract infection 9. contracture 10. Bowel and bladder dysfunction 11. Others (Please mention)	
2.9	Earning member in the family (Write answer)		
2.10	Family income (BDT tk) (Write answer)		

Part-3: SCI related information of patient:

3.1	Duration since incidence (Write answer)		
3.2	Cause of injury (Write answer number)	A. Traumatic 1= Road traffic accident 2= Fall from height 3= Fall of over loading 4= Shallow diving 5= Motor vehicle 6= Motor cycle 7= Pedestrian – vehicle crashes 8= Bicycle 9= Gunshot injury 10= Bomb lust injury 11= Others (Mention)	
		B. Non traumatic 1=Transverse myelitis 2=inflammation of spinal cord 3=Pott's disease. 4= Others (please mention)	
3.3	Sensory Total (Write answer)		
3.4	Motor Total (Write answer)		
3.5	Neurological level (Write answer)		
3.6	ISNCSCI Diagnosis : (Write answer number)	1.Complete A 2.Incomplete B 3. Incomplete C 4. Incomplete D	

Part-4: Hand function related information of patient (DASH)

(Data were taken before and after 4 weeks of Boccia sports)

Please rate your ability to do the following activities in the last week by putting tick mark below the appropriate response

Question	No difficulty (1)	Mild difficulty (2)	Moderate difficulty (3)	Severe difficulty(4)	Unable (5)
4.1.Open a tight or new jar					
4.2.Write					
4.3.Turn a key					
4.4.Prepare a meal					
4.5. Push open a heavy door					
4.6. Place an object on a shelf above your head					
4.7. Do heavy household chores (e.g., wash walls, wash floors)					
4.8. Garden or do yard work.					
4.9. Make a bed.					
4.10. Carry a shopping bag or briefcase.					
4.11. Carry a heavy object (over 10 lbs).					
4.12. Change a lightbulb overhead.					
4.13. Wash or blow dry your hair					
4.14. Wash your back					
4.15. Put on a pullover sweater					
4.16. Use a knife to cut food.					
4.17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).					
4.18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.)					
4.19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).					
4.20. Manage transportation needs (getting from one place to another).					

4.21. Sexual activities.					

Question	not at all (1)	slightly (2)	moderately (3)	quite a bit (4)	extremely (5)
4.22. During the past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbors or groups?					

Question	not limited at all(1)	slightly limited (2)	moderately limited (3)	very limited (4)	unable (5)
4.23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?					

Please rate the severity of the following symptoms in the last week. (Put the tick mark)

Question	None (1)	Mild (2)	Moderate (3)	severe (4)	Extreme (5)
4.24. Arm, shoulder or hand pain.					
4.25. Arm, shoulder or hand pain when you performed any specific activity.					
4.26. Tingling (pins and needles) in your arm, shoulder or hand.					
4.27. Weakness in your arm, shoulder or hand.					
4.28. Stiffness in your arm, shoulder or hand.					

Question	no difficulty (1)	mild difficulty (2)	moderate difficulty (3)	severe difficulty (4)	so much difficulty that I can't sleep

					(5)
4.29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand?					

question	strongly disagree (1)	disagree (2)	neither agree nor disagree (3)	agree (4)	strongly agree (5)
4.30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem.					

DASH DISABILITY/SYMPTOM SCORE	

SPORTS/PERFORMING ARTS MODULE (OPTIONAL):

Please put tick mark below the number that best describes your physical ability in the past week.

Did you have any difficulty?

question	no difficulty (1)	mild difficulty (2)	moderate difficulty (3)	severe difficulty(4)	unable (5)
4.1. using your usual technique for playing your instrument or sport?					
4.2. playing your musical instrument or sport because of arm, shoulder or hand pain?					
4.3. playing your musical instrument or sport as well as you would like?					
4.4. Spending your usual amount of time practicing or playing your instrument or sport?					

SCORING THE OPTIONAL MODULES	

Post total sensory	
Post total motor	

বাংলা প্রশ্নত

শিরোনামঃ মেরুরজ্জুতে আঘাত প্রাপ্ত টেট্রাপ্লেজিক রোগীদের হ্যান্ড ফাংশনে মডিফাইড আপার লিম্ব স্পোর্টস এর কার্যব

প - ১: অংশগ্র পরিচিতি

১.১	**অংশগ্র আইডি নং০ঃ**
১.২	তারিখঃ
১.৩	**অংশগ্র নামঃ**
১.৪	ঠিকানা গ্র / সড়ক নং্ঃ পো - অফিসঃ থানাঃ জে

প - ২০ঃ অর্থজনতা ত

(সঠিক উত নং টি লিখুন)

ক্রি নং	প্রশ্ন	ভেরিয়েবল	উত্তর
২.১	বয়স (উত টি লে)		
২.২	ি	১) পু ২) মহিলা	
২.৩	বৈ অ	১) বিবাহিত ২) অবিবাহিত ৩) তালাক প্রাপ্ত ৪) বিধবা/ বি ৫) বি	
২.৪	শিক্ষ যোগ	১) প্রাতি শি ২) প্রা শি ৩) মা শি ৪) উচ্চ মাধ্যমিক শিক্ষা) স্নাতক / স্নাতকোত্তর	
..	পেশা	) ....) শিক্ষার্থী) শ্রমিক) ব্যবসায়ী) .....) রাজমিস্ত্রি) ..... ৪) .....) অন্যান্য (উল্লেখ করুন)	
..	..... সদস্য সংখ্যা (উত্তর .. লেখুন)		
..	..... স্থান	) গ্রাম) .....)	
..	কো- মর্বিডিটি	) .....) উচ্চরক্ত) হেটারোটপিক	

		□) □□□□□□□ □□ □) শ্বা □□□□□ □) □□□□□□□ □□□□□□□□□□ □) □□□□□□□□ ডিসরিফ্লেক্সিয়া □) মূত্রনালীর সংক্রমণ □) কন্ট্রাকচার □□) অন্ত্র □ মূত্রথলীর কর্মহীনতা □□) অন্যান্য (উল্লেখ করুন)	
□.□	উপার্জনক্ষম ব্যক্তি সংখ্যা (উত্তর □□ লেখুন)		
□.□□	□□□□□□□□ □□ (□□□) (উত্তর □□ লেখুন)		

পর্ব-৩০ মেরুর □□□□ সংক্রান্ত প্রশ্ন

(□□□□ উত্তর □□ □□ □□□□□)

□.□	□□□□□ □□□ (উত্তর □□ লেখুন)		
□.□	□□□□□ □□□□	□) □□□□□□□□ □) □□□ দূর্ঘটনা □) উচ্চত থেকে □□□ □) অতিরিক্ত বোঝা □□□□ □□□ □□□□ □) □□□□□ □□□□□ □□□ দেয়া □) মোটরযান □) মোটরসাইকেল □) রাস্তা □□□□□□ □□□ দূর্ঘটনা	

		8) □□□□□□□□ □) বন্দুকের গুলীর □□□□ □□) বোমা বিষ্ফোরণের □□□□ □□) অন্যান্য (উল্লেখ করুন)	
		□) □□□□□□□□ □□ □) ট্রান্সভার্স মা□□□□□□ □) মেরু প্রদাহ □) □□□ □□□□ □) অন্যান্য (উল্লেখ করুন)	
□.□	মোট সে (উত্তর □□ লেখুন)		
□.□	মোট □□□ (উত্তর □□ লেখুন)		
□.□	□□□□□□□□□□ লেভেল (উত্তর □□ লেখুন)		
□.□	□□ □□ □□ □□ □□ □□ □□ ড্যায়াগনোসিসঃ	□) কমপ্লিট- □ □) ইনকমপ্লিট-□□ □) ইনকমপ্লিট- □□ □) ইনকমপ্লিট- □□	

পর্ব-৪০। রোগীর হা।।।। কর্মক্ষ সম্বন্ধী তথ্য

(বচ্চা খেলার আগে এবং ৪ সপ্তাহ পরে তথ্য গ্রহন করা হয়েছে)

(।।। ।।। ।।।।। নিম্নলিখিত ক্রিয়াক সক্ষমত গুলোতে টি। চিহ্ন ।।।)

প্রশ্ন	কোনো সমস্যা ।। ।। (।)	অল্প সমস্যা ।। (।)	মোটামুটি সমস্যা ।। (।)	।।।। সমস্যা ।। (।)	অক্ষম (।)
।.। ।। ।।।। ।।।। কোনো ব।।। খোলা					
।.। ।।।।					
।.। ।।।। ঘোরানো					
।.। ।।।।। প্রস্ত ।।।					
।.। ধাক্কা ।।।। ।।।। ।।।। খো।।					
।.। ।।।।। ।।।।। ।।।। কোনো ।।।।। ।।।।					
।.। ।।।। গৃহস্থালীর ।।। (যেমন- দেয়াল পরিষ্কার, মেঝে পরিষ্কার ।।।)					
।.। ।।।।। ।।।। আঙ্গিনার ।।।					
।.। ।।।।।। ।।।					
।.।। ।।।।।। ব্যাগ ।।।। ব্রিফকেস ।।।।					
।.।। ।।।। ।।।।।।। ।।। (।। পাউন্ডের ।।।)					
।.।। ।।।।। ।।।।।। ।।।। বাল্ব পরিবর্তন					
।.।। ।।।। ধৌত ।।।। শুকানো					
।.।। ।।।।। ।।। ধৌত ।।।					
।.।। সোয়েটার প।।।।। ।।।					
।.।। ।।। ।।।। খাদ্য ।।।।। ।।।।					
।.।। ।।।।।।।।।।।। ।।। যেখানে সামান্য প্রচেষ্ট প্রয়োজন (যেমন- কার্ডখেলা, ।।।। কার্য)					
।.।। ।।।।।।।।।।।। ।।। যেখানে বাহু, ।।।, ।।।।। ।।।। সামান্য ।। ।। প্রভাব ।।। (যেমন- ।।।, ।।।।।, টেনিস ইত্যাদি)					
।.।। ।।।।।।।।।।।। ।।। যেখানে ব।।।।। মুক্ত					

সঞ্চালন □□□□ □□ (যেমন- ফ্রিসবি, ব্যাডমিন্টন ইত্যাদি)					
□.□□ □□□□□□□□ প্রয়োজন নিয়ন্ত্রণ □□□ (□□ □□□□ থেকে অন্য □□□□□ □□□□)					
□.□□ যৌন কার্যক্রম					

প্রশ্ন	□□□□ □ □□ (□)	সামান্য (□)	মোটামুটি মাত্রায় (□)	বেশ মাত্রায় (□)	□□ মাত্রায় (□)
□.□□ □□ সপ্তাহে, □□□□□ বাহু, □□□, □□□ □□□□□ □□□□□□, বন্ধু , প্রতিবেশিদের □□□□ গ্রুপের □□□□ □□□□□□ কার্যকলাপে f□ □□□□□ □□□□ সৃষ্টি ব□□□□□?					

প্রশ্ন	কোনো সমস্যা □□ □□ (□)	সামান্য □□□□ (□)	মোটামু·□□ □□□□ (□)	□□□□ বেশী □□□□ (□)	অক্ষম (□)
□.□□ □□ সপ্তাহে, □□□□□ বাহু, □□□, □□□□□ সমস্যার জন্য □□□□□ কর্মক্ষে□ □□□□ দৈনন্দিন □□□□ কোনো ব□□□ সৃষ্টি ব□□□□ □□?					

□□ সপ্তাহের নিম্নোক্ত উপসর্গের তীব্রতা □□□□□□□□? (□□□ চিহ্ন □□□)

প্রশ্ন	□□□□ □ □□ (□)	□□□□ (□)	মোটামুটি (□)	তীব্র (□)	প্রচন্ড (□)
□.□□ বাহু, □□□ □□□□ □□□□□ ব্যাথা					
□.□□ কোনো নির্দি □□□ সম্পাদনে বাহু, □□□ □□□□ □□□□ ব্যাথা					
□.□□ বাহু, □□□ □□□□ □□□□ □□□□ □□□□					
□.□□ বাহু, □□□ □□□□ □□□□ দূর্বলতা					
□.□□ বাহু, □□□ □□□□ □□□□ শক্তভাব					

প্রশ্ন	কোনো সমস্যা □□ □□ (□)	অল্প সমস্যা □□ (□)	মোটামুটি সমস্যা □□ (□)	□□□□ সমস্যা □□ (□)	□□□□ সমস্যা □□ যে □□□□□ □□□□ □□ (□)
□.□□ □□ সপ্তাহে □□□□□ বাহু, □□□ □□□□ □□□□□ ব্যাথার জন্য □□□ □□□□□□ সমস্যা □□□□□?					

প্রশ্ন	□□□ অসম্মতি প্রকাশ □□□ (□)	অসম্মতি প্রকাশ □□□ (□)	□□ সম্মতি □□ অসম্মতি প্রকাশ □□□ (□)	সম্মতি প্রকাশ □□□ (□)	□□□ সম্মতি প্রকাশ □□□ (□)
□.□□ □□□ □□□□ বাহু, □□□ □□□□ □□□□□ সমস্যার জন্য সল্প সক্ষম, সল্প আত্মবিশ্বাসী □□□□ সল্প সার্থক বোধ □□□।					

□□□□□□□□ □□□□□□□□□/□□□□□□□ স্কোর	

স্পোর্স্ট /পারফর্মিং আর্টস ম□□□□ (ঐচ্ছিক)

□□□ □□□ □□□□□ গতসপ্তাহের □□□□□□ ক্ষমতার □□ □ □□□ চিহ্ন □□□।

□□□□ কোনো □□□□□□ □□□□?

প্রশ্ন	কোনো সমস্যা □□ □□ (□)	অল্প সমস্যা □□ (□)	মোটামুটি সমস্যা □□ (□)	□□□□ সমস্যা □□ (□)	অক্ষম (□)
□.□ □□□□□ নিজস্ব কৌশলে বাদ্যযন্ত্র □□□□□□ □□□□ খেলাধুলা					
□.□ বাহু, □□□ □□□□ □□□□ ব্যাথার জন্য বাদ্যযন্ত্র □□□□□□ □□□□ খেলাধুলা					
□.□ যেভাবে পছন্দ সেভাবে □□□□□ বাদ্যযন্ত্র □□□□□□ □□□□ খেলাধুলা					
□.□ বাদ □□□□□□ □□□□ খেলাধুলা □□□□□□ □□□□□ □□□ ব্যয়					

স্কোরিং দা □□□□□□ □□□□	

পোস্ট মোট সে (উত্তর □□ লেখুন)	
পোস্ট মোট □□□(উত্তর □□ লেখুন)	

BANGLADESH HEALTH PROFESSIONS INSTITUTE

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

Ref: CRP/BHPI/IRB/06/2021/468

Date: 16/06/2021

To,
Sultana Yasmin
4th year B.Sc. in Physiotherapy
Session: 2015-2016, Student ID: 112150315
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal **"Effectiveness of Modified Upper limb Sports on Hand Function in Tetraplegic Spinal Cord Lesion Patient."** by ethics committee.

Dear Sultana Yasmin,
Congratulations.
The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned dissertation, with yourself, as the Principal investigator. The following documents have been reviewed and approved

Sr. No.	Name of the Documents
1.	Dissertation proposal
2.	Questionnaire (English & Bangali version)
3.	Information sheet and consent form

The purpose of the study is to find out Effectiveness of Modified Upper limb sports on Hand Function in Tetraplegic Spinal Cord Lesion Patient. The study involves use of a questionnaire to explore that may take 20 to 30 minutes to answer the questionnaire and there is no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented from at the meeting held at 8.30am on 1st March, 2020 at BHPI (23rd IRB Meeting).
The Institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964-2013 and other applicable regulation.

Best regards

Muhammad Millat Hossain
Assistant Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB)

CRP-Chapain, Savar, Dhaka-1343, Tel : 7745464-5, 7741404
E-mail : principal-bhpi@crp-bangladesh.org, Web: bhpi.edu.bd, www.crp-bangladesh.org

Permission Letter

Date: 14th June, 2021

Head
Department of Physiotherapy
Centre for the Rehabilitation of the Paralysed (CRP)

Through: Head, Department of Physiotherapy, BHPI

Subject: Prayer for seeking permission to collect data for conducting research project.

Sir,

With due respect and humble submission to state that I am Sultana Yasmin, a student of 4th year B. Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: **"Effectiveness of Modified Upper limb sports on Hand Function in Tetraplegic Spinal Cord Lesion Patient."** under the supervision of Kazi Md.Amran Hossain, Lecturer, Department of Physiotherapy, BHPI, CRP, Savar, Dhaka-1343. I want to collect data for my research project from the Department of Physiotherapy at CRP. So, I need permission for data collection from the Spinal Cord Injury Unit of Physiotherapy Department at CRP (CRP, Savar, Dhaka-1343). I would like to assure that anything of the study will not be harmful for the participants.

I, therefore pray and hope that your honor would be kind enough to approve my thesis proposal and give me permission to start data collection and oblige thereby.

Sincerely

Sultana

Sultana Yasmin
4th professional B.Sc. in Physiotherapy
Roll: 44, Session: 2015-16, ID:112150315
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Forwarded to the Head of PT, BHPI
14.06.2021
Kazi Md. Amran Hossain
Lecturer
Dept. of Physiotherapy
BHPI, CRP, Savar, Dhaka-1343

Recommended
16.06.2021
Md. Shofiqul Islam
Associate Professor & Head
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Chapain, Savar, Dhaka-1343

Approved
MUHAMMAD ANWAR HOSSAIN
Senior Consultant &
Head of Physiotherapy Dept
Associate Professor, BHPI
CRP Savar Dhaka-1343