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Clinical Practice Guideline of Physiotherapy Intervention for Lower Limb on Spinal Cord Injury

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DECLARATION

This work has not previously been accepted in substance for any degree and isn't concurrently submitted in candidature for any degree. This dissertation is being submitted in partial fulfillment of the requirements for the degree of M.Sc. in Physiotherapy. This dissertation is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged by giving explicit references. A Bibliography is appended. I confirm that if anything identified in my work that I have done plagiarism or any form of cheating that will directly awarded me fail and I am subject to disciplinary actions of authority. I confirm that the electronic copy is identical to the bound copy of the Thesis. In case of dissemination the finding of this project for future publication, research supervisor will highly concern and it will be duly acknowledged as graduate thesis.

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Acronyms

ADL:	Activity of Daily Living
AGREE II:	Appraisal of Guidelines for Research and Evaluation II
AIS:	ASIA Impairment Scale
APTA:	American Physical Therapy Association
ASIA:	American Spinal Injury Association
BHPI:	Bangladesh Health Professions Institute
BMR:	Basal Metabolic Rate
BMRC:	Bangladesh Medical Research Council
BWST:	Body Weight Support Treadmill
CAT:	Continuous Acupuncture Treatment
CNS:	Central Nervous System
CPG:	Clinical Practice Guidelines
CPS:	Clicks Per Second
CRP:	Centre For The Rehabilitation of The Paralysed
DU:	University of Dhaka
FES:	Functional Electrical Stimulation
GRADE:	Grading Recommendation, Assessment, Development, and Evaluation
IMU:	Inertial Measurement Unit
IRB:	Institution Review Board
ISNCSCI:	International Standards for Neurological Classification of Spinal Cord Injuries
IYP:	Integrated Yoga and Physiotherapy
NTSCI:	Non Traumatic Spinal Cord Injury
PRE:	Progressive Resistance Exercises
PRISMA:	Preferred Reporting Items for Systematic Reviews and Meta- Analyses
QOL:	Quality of Life
RAGT:	Robot-Assisted Gait Training
RCT:	Randomized Controlled Clinical Trials
SCI:	Spinal Cord Injury
TENS:	Transcutaneous Electrical Nerve Stimulation
tSCS:	Transcutaneous Spinal Cord Stimulation

VAC: Voluntary Anal Contraction

VAS: Visual Analog Scale

WHO: World Health Organization

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Abstract

Background: Spinal cord injury (SCI) is a complex and challenging destructive disease of the central nervous system, resulting in permanent motor and sensory dysfunction due to disruption of neural circuits composed of descending motor neurons and ascending sensory neurons. Clinical practice guidelines are a key component of medicine, as they provide evidence-based recommendations for physicians and other health care professionals about the management of care for patients with diseases or other clinical conditions. A number of important developments involving clinical practice guidelines have emerged in the past few years. This View point discusses some of the more important of these.

Objectives: Examining the effects of Physiotherapy treatment protocol in paraplegic SCI patients

Methodology: This Narrative review was done and reported following the PRISMA guidelines. An automated electronic search of Pedro, PubMed, and Google Scholar database was conducted using key phrases such as Paraplegic SCI, Physiotherapy, Rehabilitation, clinical practice guideline. The inclusion criteria were subjects with a confirmed diagnosis of paraplegic spinal cord injury, articles published in the English language between 2010 and 2023. The Physiotherapy Evidence Database (PEDro) scale was used to rate the effectiveness of the available studies and score of at least 5 out of 10 were used. Research studies that contained subjects expressing complaints of another neurological condition as well as articles evaluating cognitive impairments were excluded from the study.

Result: Initially, the database identified 524 studies. 22 studies were identified as possibly matching the inclusion criteria.

Conclusion: The suggestions apply to the treatment of people with SCI throughout their lives, from the time of the injury to healthy aging in the community.

Key words*: Paraplegic SCI, Physiotherapy, Rehabilitation, clinical practice guideline.*

CHAPTER-I INTRODUCTION

1.1 Background

Spinal cord injury (SCI) is a hard and complicated disease that affects the central nervous system. It causes persistent motor and sensory impairment as a result of the breakdown of neural circuits that are composed of ascending sensory neurons and descending motor neurons. In addition, because SCI is a serious injury caused by multiple primary and secondary mechanisms simultaneously or sequentially, it frequently results in chronic consequences such as respiratory dysfunction, cardiovascular complications, neuropathic pain, spasticity, bladder and bowel dysfunction, and mental illness (Liu, et al., 2022).

The majority of the neuronal cell bodies in the spinal cord are located in the grey and white matter of the core areas of the spinal cord, which are surrounded by the longitudinally oriented spinal tracts that make up the white matter. The grey matter is composed of different sections that are made up of sensory and motor neurons. Axons from motor neurons can enter the spinal cord through segmental nerves, also known as roots, while axons from sensory neurons can depart the spinal cord by segmental nerves. A spinal cord injury is a complex condition that can result in a range of impairments, the most notable of which are varying degrees of motor and sensory loss. When an injury occurs at a more distal level, the spinal cord's capacity to carry out its typical functions is disrupted (Alashram et al., 2020).

Loss of sensory function and the ability to govern voluntary movement below the damage caused by SCI occurs very immediately and is irreversible. A person who suffers from a condition known as low-thoracic paraplegia is unable to feel or contract his muscles below the waist. People with tetraplegia have complete paralysis of both the upper and lower bodies (Guertin, 2005). According to Alizadeh et al. (2019), the most prevalent causes of spinal cord injuries include car accidents, falls, and acts of aggression; however, SCIs can also be caused by participating in dangerous or improper sports or leisure activities.

A traumatic spinal cord injury, also known as an tSCI, is the result of a direct and immediate mechanical insult to the spinal cord (such as a contusion, compression,

and/or laceration), which is produced by the disruption and dislocation of the vertebral column. The most prevalent causes of traumatic spinal cord injuries are slips and falls, motor vehicle accidents, sports-related injuries, gunshot injuries, and knife wounds. This kind of injury is often brought on by processes that involve flexion, compression, hyperextension, or flexion-rotation of the affected joint. The majority of individuals diagnosed with tSCI experience permanent motor deficits (weakness or paralysis) as well as sensory impairments and autonomic dysfunction (Ahuja et al., 2017).

A unique kind of spinal cord injury known as a non-traumatic spinal cord injury (NTSCI) is one that was not brought on by a traumatic event. The following are some of the possible causes of NTSCI: Both congenital and acquired, respectively: Spina bifida, cerebral palsy, dysraphism, and diastematomyelia are few examples of congenital anomalies. Amyotrophic lateral sclerosis, Friedreich's ataxia, hereditary spastic paraparesis, infantile neuroaxonal dystrophy, Peiraeus-Merzbacher disease, Canavan's disease, and spinal muscular atrophy are all examples of degenerative conditions that affect the central nervous system. Infectious: Most can cause transverse myelitis: viral (herpes simplex virus, varicella-zoster virus, cytomegalovirus, human T cell leukaemia virus-1, HIV, poliovirus); bacterial (Pott's disease, Mycobacterium spp.); fungal (Cryptococcus spp.); parasitic (Toxoplasma gondii, Schistosoma manzoni). Multiple sclerosis and transverse myelitis are examples of inflammatory diseases. Ischemic Comparing arterial to venous circulation: aortic dissection; cardiac arrest; systemic hypotension; atherosclerosis; thrombosis; embolism; iatrogenic (aortic repair); arteriovenous malformations Genetics as well as physiology Glutathione, methylcrotonylglycinuria, gangliosides, myelin protein zero, adrenomyeloneuropathy, abetalipoproteinemia, and vitamin B12 insufficiency are some of the conditions that are associated with this disorder. Primary tumours and metastatic tumours (both intramedullary and extramedullary) have been found. Rheumatological and degenerative Spondylolysis, stenosis, disc disease, Paget's disease, rheumatoid arthritis, and posterior degenerative longitudinal ligament ossification are some of the conditions that might be associated with spondylolysis. Post-injury sequelae found that patients with syringomyelia had delayed functional decline (Kang et al., 2018).

It doesn't matter if it's TSCI or NTSCI; the economic burden is becoming an ever more significant worry for both people and society as a whole. According to research done

by Lenehan et al. (2012), the estimated lifetime economic impact of a spinal cord injury ranged from $1.47 million to $3.03 million per patient in Canada. This figure accounts for patients who suffered incomplete paraplegia as well as those who underwent total tetraplegia as a result of their condition.

A damage to the spinal cord is the most life-altering thing that can happen to a person, and the individual will confront significant obstacles when attempting to adjust to the rehabilitation procedures. Some patients are able to recover a partial ability to do daily tasks after going through the rehabilitation process, while others are left with a severe handicap or experience a permanent change in their activities of daily life (Kumar & Gupta, 2016). According to the findings of one study, the primary objective of the rehabilitation programme for individuals who have spinal cord injuries is not only to reduce the risk of mortality and disability but also to enhance the overall quality of life of those individuals who have spinal cord lesions (Ramakrishnan et al., 2011). According to Backx et al. (2018), a spinal cord injury has a significant influence on the patient's personal life, social life, and professional growth. This is followed by a significant psychological and financial burden, which places a significant amount of strain on the patient's family as well as on society.

The presence of SCI is associated with unfavourable alterations in metabolic profiles and body composition, both of which contribute to significantly worse health outcomes in this population. According to Sisto et al. (2014), the International Classification of Functioning, Disability, and Health (ICF) developed by the World Health Organisation is a helpful framework for comprehending the intricate contact between the numerous elements that can affect impairments, function, and involvement after a SCI.

According to Rahman et al. (2017), the epidemiology of SCI varies significantly from industrialised countries to underdeveloped countries. As a result, investigating the epidemiology requires distinct and thorough research in each of these countries. In order to improve the management of SCI, it is vital to have a better understanding of both the prevalence and incidence of the condition (Singh et al., 2014). This will allow for a better understanding of the rate of occurrence as well as measures to prevent it.

In the United States, the National Centre for Spinal Cord Injury estimates that there are around 294,000 people living with spinal cord injuries, with approximately 17,810 new

cases being diagnosed each year. Statistics show that the incidence rate of SCI in China is anywhere between 25 and 60 cases per million individuals, with the average age of onset falling somewhere between 40 and 60 years of age. The rate of occurrence is noticeably higher in males compared to that in females. The incidence of spinal cord injuries ranges from 3.6 to 195.4 cases per million persons around the world. Of these, male patients can make up as much as 78% of the total (Jazayeri et al., 2023).

Around the world, there are currently approximately 180,000 cases of SCI, and this number is continually increasing. According to the results of our research, the annual incidence of SCI in Tianjin, China, was 23.7 instances per million people, and our findings also revealed that senior people had a significantly higher risk of developing the condition. Approximately 40 million people throughout the world are diagnosed with SCI each year. Even though children make up only 1% of this population, the vast majority of those living there are young men, most of whom are between the ages of 20 and 35. A traumatic injury to the spine is more likely to occur in males than in females. The cervical region accounts for around 60% to 80% of spinal injuries in children, while the lumber region accounts for 20% to 40% of these injuries (Sakhon & Fehlings, 2001). Worldwide studies have been conducted to determine the incidence and prevalence of acute SCI on a national and regional level. Another study revealed that, there are 14–40 acute SCI cases per million people worldwide. After conducting a comprehensive analysis of epidemiological studies, researcher came to the conclusion that New Zealand had the highest national incidence (49.1 per million), followed by Fiji (10.0 per million), and Spain (8.0 per million). In North America, the states with the highest crude annual SCI incidence were Alaska (83 per million) and Mississippi (77 per million), while Alabama had the lowest incidence rate (29.4 per million). Patients diagnosed with SCI are almost always male, and the age at which cases are most common is under 30. Automobile accidents and falls among the elderly are the leading causes of SCI (Fehlings et al., 2017).

According to the annual report of admission at specialised centres like the Centre for Rehabilitation of the Paralysed (CRP) (Rahman et al., 2017), Bangladesh is a developing nation that faces a large number of socio-economic challenges as a direct result of spinal cord injuries (SCI) and other health-related complications. These challenges are found in the country's poor socioeconomic conditions. There are 16

million people in Bangladesh who are living with some form of disability. According to Islam et al. (2011), spinal cord injuries are the primary reason people in Bangladesh are unable to work.

The American Spinal Injury Association (ASIA) divides different types of spinal cord injuries into those that affect the motor and sensory systems. In 2011, the ASIA Disorder Scale underwent most recent version. The phrase "deep anal pressure" has taken the place of "deep anal sense." Functional status has a significant impact on the extent of the damage as well as whether it is complete or not. A total injury is defined as the complete loss of all motor and sensory capabilities at the distal level of the damage. A partial preservation of sensory and motor capabilities in the lower sacral segments and below the level of the nervous system is referred to as an incomplete injury. It is anticipated that this lesion would not affect deep anal feeling or anal mucocutaneous superficial sensibility (Nas, 2015). The International Standards for Neurological Classification of Spinal Cord Injuries (ISNCSCI) classifies injuries according to the neurological level of injury (the lowest level of the spinal cord with normal sensory and motor function on both sides of the body) and the ASIA Impairment Scale (AIS) score, which describes the extent of motor and/or sensory function that remains below the neurological level (Teeter et al., 2012).

This term refers to the decline or loss of motor and/or sensory function in the cervical portions of the spinal cord as a result of neural components in the spinal canal being destroyed. Arms, the trunk, the legs, and the pelvic organs all function less regularly in tetraplegia, which affects all four extremities. It does not include lesions of the brachial plexus or injury to nerves that are peripheral to the neural canal (Nas, 2015).

This phrase describes a condition when there is a loss or impairment of motor and/or sensory function in the thoracic, lumbar, or sacral (but not cervical) portions of the spinal cord as a result of neuronal components inside the spinal canal being damaged. Arm function is unaffected by paraplegia, but depending on the severity of the damage, the trunk, legs, and pelvic organs may be affected. used to describe injuries to the cauda equina and conus medullaris but not lumbosacral plexus lesions or damage to peripheral nerves outside the neural canal (Nas, 2015).

Maintaining postural stability while regaining ambulatory function is a significant obstacle for individuals with iSCI. iSCI impairs standing safety and function. Balance loss is a prominent cause of falls in this group, showing the absence of postural control in iSCI patients (Noamani et al., 2020). A spinal cord injury (SCI) causes incomplete lesions in about 60% of victims. It might be difficult for people with iSCI to regain their balance function because to abnormalities in their muscular strength, feeling, and aberrant muscle tone. One of the main causes of decreased mobility and postural control, walking capacity after discharge, and influence on balance control in daily life is balance dysfunction. Following cervical involvement in physical and therapeutic activities is frequently restricted because of the loss of voluntary motor function, poor temperature control of the affected extremities, autonomic dysfunction, and early muscular fatigue. Surgery, cell and gene therapy, tissue engineering, standard medication therapy, and surgery are all current SCI therapies. Nevertheless, these methods only work to alleviate symptoms and minimize problems, not to completely heal SCIs (Alashram et al., 2020). Traumatic acute spinal cord damage (SCI) disrupts normal sensory, motor, and autonomic function, affecting a patient's physical, psychological, and social well-being. Acute SCI has two phases. A spinal cord fracture or dislocation produces white and grey matter microhemorrhages, axonal injury, and cellular membrane disintegration. Pathophysiological processes cause neuronal homeostasis, apoptosis, and tissue degradation after the first damage. They include edema, coagulation factors, vasoactive amines, ionic imbalance, free radicals, and glutamate release. Acute SCI may reduce quality of life, function, and social independence (Fehlings et al., 2017).

Clinical practice guidelines are a key component of medicine, as they provide evidence-based recommendations for physicians and other health care professionals about the management of care for patients with diseases or other clinical conditions. A number of important developments involving clinical practice guidelines have emerged in the past few years. This Viewpoint discusses some of the more important of these.

1.2 Rationale

This treatment protocol is a narrative review of research that was done in the past. In that research, the researcher attempted to collect the entire treatment procedure for spinal cord injury paraplegic patients as well as which treatment is required for these patients. In this particular instance, the researcher looked for the paper by conducting a search with Boolean operators in Pedro, Google Scholar, PubMed, and other similar resources. The American Physical Therapy Association is working to develop recommendations for the treatment of patients who have neurological impairments that are based on evidence from current clinical practice. The purpose of this clinical guideline is to offer physical therapy procedures that are supported by evidence for the treatment of spinal cord injuries. These processes include screening, diagnosis, prognosis, intervention, and evaluation of the results.

Spinal cord injuries are a debilitating health issue that are becoming more prevalent on a daily basis in every region of the planet. This rate is also increasing at a higher rate in Bangladesh, which is a serious issue for the economics, development, and health sector of the country, as well as the burden it places on families. Following the completion of any necessary medical treatment, the patients will require appropriate rehabilitation. This service is extremely important for these individuals suffering from SCI since it enables them to participate in day-to-day activities. On the other hand, it is a source of sorrow because, with the exception of CRP, this service is not very effectively established. Because the vast majority of patients are unaware of this rehabilitation program, they are forced to endure unnecessary suffering as a result of their circumstances. SCI patients in Bangladesh do not have access to a treatment strategy or guideline that has been created or established to a high level. A set of guidelines or a treatment procedure would be a fantastic step in the right direction. This would be an excellent undertaking. Because of this, researchers attempted to devise a therapy program for those who had sustained spinal cord injuries that left them paralyzed. SCI patients can also receive novel therapy protocols such as robotic treatment, also known as robot-assisted gait training, harness walking, treadmill walking, functional electrical stimulation (FES), transcutaneous spinal cord stimulation, and others. These treatments are offered in the current day. The researchers attempted to demonstrate not just the efficacy of various therapeutic approaches but also their efficacy.

This guideline must not be interpreted as a standard of clinical treatment or used as interpretation. The criteria for establishing standards of care are all the clinical information that is available for a specific patient, and these criteria are always susceptible to modification as new scientific knowledge and technologies are developed and as patterns of treatment change. It is only recommended that you use the practice framework and parameters as a reference. There is no guarantee that every patient will have a positive result, and the recommendations shouldn't be seen as excluding any other legitimate forms of therapy or as requiring all right ones. To make a final decision about a clinical procedure or treatment plan, one must consider the clinical information provided by the patient, the diagnostic and therapeutic alternatives available, and the patient's values, expectations, and preferences. The patient's medical records should, however, be updated at the moment the relevant clinical decision is taken if there is any major deviance from the established criteria (Simonds et al., 2022).

This guideline provides evidence-based recommendations for the optimal type and timing of rehabilitation in patients with paraplegic SCI. The ultimate goal of this guideline is to improve outcomes and reduce morbidity in patients with SCI by promoting standardization of care, encouraging clinicians to make more evidence-informed decisions and influencing policy changes to ensure adequate resource allocation. An introductory article in this focus issue provides further background information on SCI and summarizes the rationale, scope, and specific aspects of care covered by this guideline. This article is titled “Clinical practice guideline for paraplegic spinal cord injury patients: Recommendations for treatment” These guidelines are intended for use by neurologists, spine surgeons, physiatrists, sport medicine physicians, and Physiotherapists.

1.3 Research Question

What is evidence-based physiotherapy regimens and their impact on paraplegic spinal cord injury patients?

1.4 Aim of the Study

Describe the available evidence based and current physiotherapy programs and their effectiveness of interventions on Paraplegic SCI patients. Identify areas for future rehabilitation research for these patients.

1.5 Objectives

1.5.1 General Objective

To develop a recommendation for Clinical Practice Guideline of Physiotherapy Intervention for Lower Limb on Spinal Cord Injury.

1.5.2 Specific Objectives

i. To identify the Rehabilitation strategies, including conventional interventions and advanced interventions based on scientific evidence, will reviewed.
ii. To explore Identify areas for future rehabilitation research for these patients.

1.6 Conceptual Framework

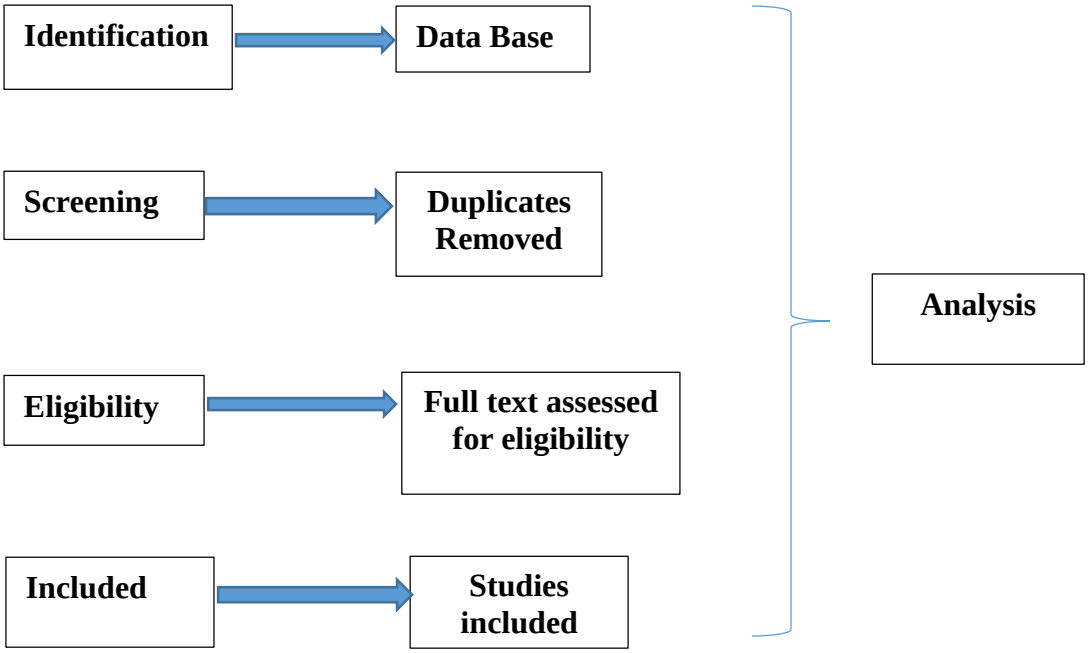

Figure 1: Conceptual Framework

CHAPTER- II LITERATURE REVIEW

Impulses go both in one direction, from the brain to the body, and in the other direction, from the body to the brain, along the spinal cord. The spinal cord is composed of nervous tissue, and the fundamental component of nervous tissue is known as a neuron. The spinal cord extends from the medulla oblongata to the conus medullaries, and it begins in the medulla oblongata and terminates in the conus medullaries (Rahman, Ibrahim, Jamil, & Leman, 2014).

A lesion to the spinal cord, often known as a spinal cord injury (SCI), can cause deficits in the motor, sensory, and autonomic nervous systems. It makes people more likely to have dysfunction in several systems, which can then lead to secondary issues. Medical repercussions that lead to functional limits are what this condition is characterised as. According to Munce et al. (2013), there are a variety of secondary issues that can arise after a spinal cord injury, such as pressure ulcers, urinary tract infections, bowel-bladder problems, fractures, chronic pain, and psychological disorders.

A traumatic spinal cord injury can lead to tetraplegia and paraplegia, both of which result in an impairment of the trunk and the lower limbs. The paraplegic person's inability to move around resulted in a reduction in both their exercise capacity and their stroke volume (Tweedy et al., 2017).

SCI is one of the most urgent health crises that has to be addressed worldwide, and it has the greatest occurrence rate of all the traumatic events that can occur. According to Popa et al. (2010), the annual prevalence ranges from 15 to 52.5 in every million persons. On the other hand, the incidence rate was found to range anywhere from 12.06 to 61.6 per million people, as stated by Ning et al. (2012). According to Tweedy et al. (2017), the incidence ratio of SCI can be predicted to be 23 instances per million people over the world, despite the fact that there is a substantial gap between the rates in different regions, such as North America (40 per million) and Australia (15 per million). In the recent past, around 2.1 million persons in the United States and Canada have been given a diagnosis of traumatic or non-traumatic SCI (Tomasone et al., 2013).

Among all SCI patients, 42% suffer from paraplegia (Popa et al., 2010). However, in the case of western countries such as Norway, accidents linked with falls are the typical

cause, whereas in Asian countries, events related to falls are steadily increasing day by day (Ning et al., 2012).

Males are more likely to be impacted than females on a global scale, and the age range of those who are affected is stated to be between 18 and 32 years old. According to Lee et al. (2014), SCI can potentially affect those over the age of 65 in nations that have an excessive population. According to the findings of another study (Popa et al., 2010), eighty percent of all local residents who have had spinal cord injuries are young men between the ages of 15 and 35.

A spinal cord injury (SCI) is considered either full or incomplete according to whether or not the sacral section was preserved. The assessment of each dermatome with a light touch and pinprick sensations, voluntary anal contraction (VAC), and ten main muscles on each side of the body are used to detect motor or sensory sparing in the caudal sacral segment of the body. Complete injury is the term that is used when there is no motor or sensory function in the lowest sacral segments (S4–S5), whereas incomplete injury is the term that is used when there is the preservation of motor and sensory function below the neurological level that includes the lowest sacral segments S4–S5 (Haque et al., 2018). Complete injury is the term that is used when there is an absence of motor and sensory function in the lowest sacral segments (S4–S5).

According to Kawanishi and Greguol (2013), a spinal cord injury causes a significant amount of individual disability, which is manifested in significant adjustments to one's way of life. People between the ages of 25 and 29 are the most likely to be impacted by CRP in Bangladesh. Among those affected, males are afflicted more (83%) than females, and the majority (92%), rather than the minority (8%) originated from rural areas. According to Islam, Hafez, and Akter (2011), the majority of patients suffer from paraplegia. Cervical lesions are present in 44% of cases, thoracic lesions are present in 27% of cases, and lumber lesions are present in 29% of cases.

According to the findings of Nwankwo and Uche (2013), the age range of 31–45 years old is the one most likely to be impacted by SCI, and the male is more likely to be affected than the female (4.3:1). The cervical spine was the location of 53% of injuries, the thoracic spine was responsible for 22%, and the lumbar spine was responsible for 25%. Pain in the neck or back, which typically radiates because of nerve root irritation; sensory disturbance distal to the neurological level; and weakness or flaccid paralysis

below this level are all clinical symptoms of a spinal cord injury (Grundy & Swain, 2002).

According to New, Farry, Baxter, and Noonan (2013), an injury or damage to the spinal cord can result in a wide variety of impairments, activity limitations, and participation restrictions that are detrimental to society. According to Ali and Tawfiq (2013), spinal cord injuries have a substantial impact not only on the individuals who sustain them but also on their families. These injuries are also a leading source of both mortality and morbidity. In a developing country like Bangladesh, the life expectancy of spinal cord injury patients was much lower than the developed country (Razzak, Helal, & Nuri, 2011).

The most important aspects of social involvement include duties and activities inside the household and the family, productive activities such as working, going to school, and volunteering, social networks, leisure activities, mobility, and the ability to support oneself economically. People with spinal cord injuries should be properly reintegrated into society in every aspect if social involvement is to be regarded a recovery goal. According to the findings of several studies, decreased mobility is linked to unemployment, which in turn raises the risk of secondary problems and low self-esteem in individuals (Kennedy, Lude, & Taylor, 2006).

A person's perception of their quality of life is influenced by their level of contentment or discontentment with aspects of the community in which they reside that are significant to them. Quality of life is a multidimensional notion. According to Kreuter, Siosteen, Erkholm, Bystrom, and Brown (2005), the quality of life (QoL) of a patient can be affected by a variety of aspects, including physical, psychological, and social function; the ability to work; interactions with other people in society; and so on.

A recent study found that patients with heart disease, diabetes, high blood pressure, and obesity require more health-related care. This has a direct effect on quality of life, especially for people with spinal cord injuries. Education, transportation, a job, independence, social support, and other factors can all interfere directly with quality of life for people with SCI (Kawanishi & Greguol, 2013).

According to Tweedy et al. (2017), the term "physical ability" refers to any type of body motion that is generated by the skeletal muscles of the body and makes use of the energy

produced by the body. Exercise can be defined as a form of physical movement that is purposefully planned, arranged, and performed on a regular basis in order to improve the body (Tiu et al., 2017).

Regular physical activity (PHA) reduces visceral cholesterol, insulin resistance, and endothelial dysfunction and is important for sexual function: 150 minutes/week Moderate-intensity PHA is associated with maintaining normal erectile function in men (Janiszewski et al., 2009). And the Androx Vienna Municipal Survey found that the international Index 5-item (IIEF-5) question paper score and PHA level of erection function had positive correlations (Kratzik et al., 2009). Evidence strongly said that exercise can develop muscle strength, progress cardiorespiratory fitness, effective individuality, and thus standard living of persons with SCI (Tweedy et al., 2017).

Following a SCI, problematic vocal patterns will present themselves very quickly. Initially, ARFL exacerbation or sedative dysfunction and, subsequently, neurogenic degenerative overdose greatly alter the simulation and outcome based on the extent of the injury (Kratzik et al., 2009). This is due to the fact that ARFL exacerbation or sedative dysfunction occur simultaneously. The abnormalities in the kidneys that emerge from this condition can lead to a variety of health issues, including social incapacity, recurrent urinary tract infections, vesicortic reflux, upper extremity dehydration, and hydronephrosis. The consequence of this is long-term damage to the kidneys, which ultimately results in renal failure. According to Guy and Grundy (2002), one of the most crucial aspects of management is the maintenance of renal awareness.

In spite of the fact that morbidity and mortality rates for spinal cord injury patients have significantly decreased and gradually decreased over the past five decades. A study conducted in a developing country such as Bangladesh described that the lack of availability of prevention programmes, unorganised and improper facilities, and management protocols for spinal cord injury patients are responsible for high morbidity and mortality rates (Razzak et al., 2011).

Following an accident, the primary goals of rehabilitation are to minimise the risk of developing secondary problems, speed up neurorecovery, and improve overall function. Other goals include increasing a patient's independence in performing activities of daily living, assisting a patient in coming to terms with a new way of life, and making it

easier for a patient to rejoin their community. The principles of motor control, activity dependent neuroplasticity, and restoring function by addressing the underlying deficits are the primary focuses of several different rehabilitation treatments that have been developed in recent years. It is vital to determine the most appropriate strategies for rehabilitation given the physical and psychological advantages that can be gained from the process (Fehlings et al., 2017). These strategies should include what techniques and exercises to use as well as the ideal time of intervention.

Because the amount of research information is growing at such a rapid rate, it can be difficult for medical practitioners to keep up with the most recent findings in their field and the therapeutic recommendations that are related to those findings in all areas of treatment (Peters et al., 2020). Clinical Practice Guidelines, often known as CPGs, are an essential component in helping to close this knowledge gap. CPGs are knowledge tools that help evidence-based decision-making and are consisting of systematically generated statements that encourage high-quality practice across the continuum of care. CPGs can be found in a variety of healthcare settings, including hospitals, clinics, and private practices. According to Davies (2002), the inclusion of evidence-informed practice recommendations inside clinical practice guidelines (CPGs) has the potential to lessen practice variation, increase the quality of care, and aid medical practitioners in making clinical decisions that are founded on evidence and advance practices.

There are a few guidelines that provide recommendations for all of the members of the interprofessional care team. These recommendations are adjusted to the level of injury and severity of harm sustained by the individual. It is necessary to have a CPG that identifies best practices across the entirety of the SCI care continuum. The clinical practice guidelines (CPGs) that have the greatest potential to affect systems of care should include, in addition to advice for quality treatment, recommendations that are targeted for specific stakeholders. These stakeholders may include, but are not limited to, healthcare administrators, lawmakers, and those who have lived experience. Despite their good intentions, clinical practice guidelines (CPGs) can have a negative impact on public policy towards patients. For instance, recommendations against an intervention may prompt service providers and/or healthcare funders in a single-payer health system to curtail access to the intervention and/or withdraw financing for the product or service. Also, recommendations for costly therapies that are rarely practical

may cause the displacement of resources needed for other services (across the care continuum) that are of greater value to patients under a system of healthcare that is paid for by a single payer (Pastakos et al., 2021).

CHAPTER-III METHODOLOGY

3.1 Study Design

Researchers came up with a narrative review of the treatment programme that is intended for patients who have suffered paraplegic spinal cord injuries. A panel of experts from a variety of disciplines worked together to make recommendations for the patients' rehabilitation after analysing the data and drawing on their professional experience. A process that is based on the checklist that was produced by the Conference on Guideline Standardisation (COGS) was developed in order to identify the objective and scope of the guideline as well as to direct its development. Clinical practice guidelines (CPG) for spinal cord injuries are now available; however, they only address a small piece of the care continuum or a particular impairment. As a consequence of this, they do not adequately address each and every one of the key clinical questions that come up during the course of a patient's treatment. Davies et al. (2002) developed an instrument called the Appraisal of Guidelines for Research and Evaluation II (AGREE II) that was used to evaluate the quality of CPGs that were eligible for the study. Systematic assessments were carried out in order to gather the data supporting the suggestions. These evaluations were carried out on the basis of recognised methodological criteria. The several evaluations included in this focus issue provide specifics regarding the techniques that were followed for each individual subject area. The methodologies that were described by the Grading Recommendation, Assessment, Development, and Evaluation (GRADE) Working Group were utilised in order to conduct the analysis that determined the overall quality (strength) of the evidence. The GRADE Guideline Creation Tool was used to record the procedure, grade the relevance of the results, weigh the advantages and disadvantages of various alternatives, and evaluate the believability of the recommendations (Schunemann et al., 2013). Methodologists from Spectrum Research, Inc. worked closely with clinical writers in order to perform the systematic reviews and provide methodological knowledge on the process of creating the guidelines. This was done in order to meet the requirements of the process. The article "Guidelines for the Treatment of Degenerative Cervical Myelopathy and Acute Spinal Cord Injury: Formulation Process and Methodology," which is also included in this special issue, provides instructions for the process of formulating guidelines.

3.2 Search Strategy

A comprehensive literature search was performed in PEDro, Pubmed, Google Scholar, database with the key words “Paraplegic Spinal Cord Injury AND Physical Therapy”, “Paraplegic Spinal Cord Injury AND Rehabilitation”, “Guideline AND Spinal Cord Injury”.

Date of Search	**Database**	**Years searched**	**Searched terms**	**Hits**	**Accessed articles**
27/12/22 **02/01/23** **04/01/23**	**Google Scholar**	**2010-2023**	•Paraplegic Spinal Cord Injury AND Physical Therapy •Paraplegic Spinal Cord Injury AND Rehabilitation •Guideline AND Spinal Cord Injury	**7550**	More than 1230 but we took 300
27/12/22 **02/01/23** **04/01/23**	**Pedro**	**2010-2023**	•Paraplegic Spinal Cord Injury AND Physical Therapy •Paraplegic Spinal Cord Injury AND Rehabilitation •Guideline AND Spinal Cord Injury	**120**	Accessed 120 but we took 98
27/12/22 **02/01/23** **04/01/23**	**Pubmed**	**2010-2023**	•Paraplegic Spinal Cord Injury AND Physical Therapy •Paraplegic Spinal Cord Injury AND Rehabilitation	**1231**	Accessed 600 but we took 126

			•Guideline AND Spinal Cord Injury		

Table 1: Search Strategy

3.3 Study Selection

Articles published in English, the use of physiotherapy as a treatment intervention, the classification of the study as an experimental trial, the assessment of balance and postural stability, and the investigation of subjects with a confirmed diagnosis of paraplegic spinal cord injury were the eligibility requirements. Research studies that contained subjects expressing complaints of another neurological condition as well as articles evaluating cognitive impairments were excluded from the study (i.e., traumatic brain injury, stroke). A first reviewer carefully made an effort to limit subjective bias as they independently evaluated each research paper to determine its eligibility. A preliminary investigation of the chosen research papers was conducted by two reviewers by looking into the titles and abstracts, and if appropriate, the complete text of the research papers was examined. The third reviewer and I discussed any further justifications for or disagreements with the published articles. The Physiotherapy Evidence Database (PEDro) scale was used to rate the effectiveness of the available studies. Eleven items on the scale look at interpretability, internal validity, and external validity. The PEDro scale is a reliable tool for assessing the methodological quality of scientific investigations since it can identify potential bias with a fair to good degree of accuracy. A blinded assessment of the included studies' methodological quality was done by two reviewers. When paired sets of included research had different results, the outcome of the studies with a higher PEDro score received more attention. Convenient randomization, assessors not being blinded, no intention to treat analysis, and no evaluation of compliance were the main sources of bias (Ghai et al., 2017). 524 articles in all were initially chosen for publishing between 2010 to 2023. 277 articles were examined after duplicates were eliminated. Of those, 249 articles were disqualified since it was clear from their abstracts that they did not satisfy the requirements for inclusion. Due to the fact that their abstracts did not clearly demonstrate that they met the inclusion criteria, twenty-eight papers were subjected to a more thorough study. Six

papers were dropped from consideration because they involved SCI patients who also had other neurological conditions and weren't intended to be experimental studies. Twenty-two articles in total were chosen for the present review's inclusion criteria. A PRISMA-compliant synopsis of systematic reviews and RCTs with a PEDro score of at least 5 out of 10 were used to create the interventions for the recommendation. Cohorts, case series, case reports, systematic reviews, and randomized controlled trials were among the research methods used. After creating the guideline, the authors talked with prominent doctors in Bangladesh who had been practicing physiotherapy for more than 10 years to double-check its applicability.

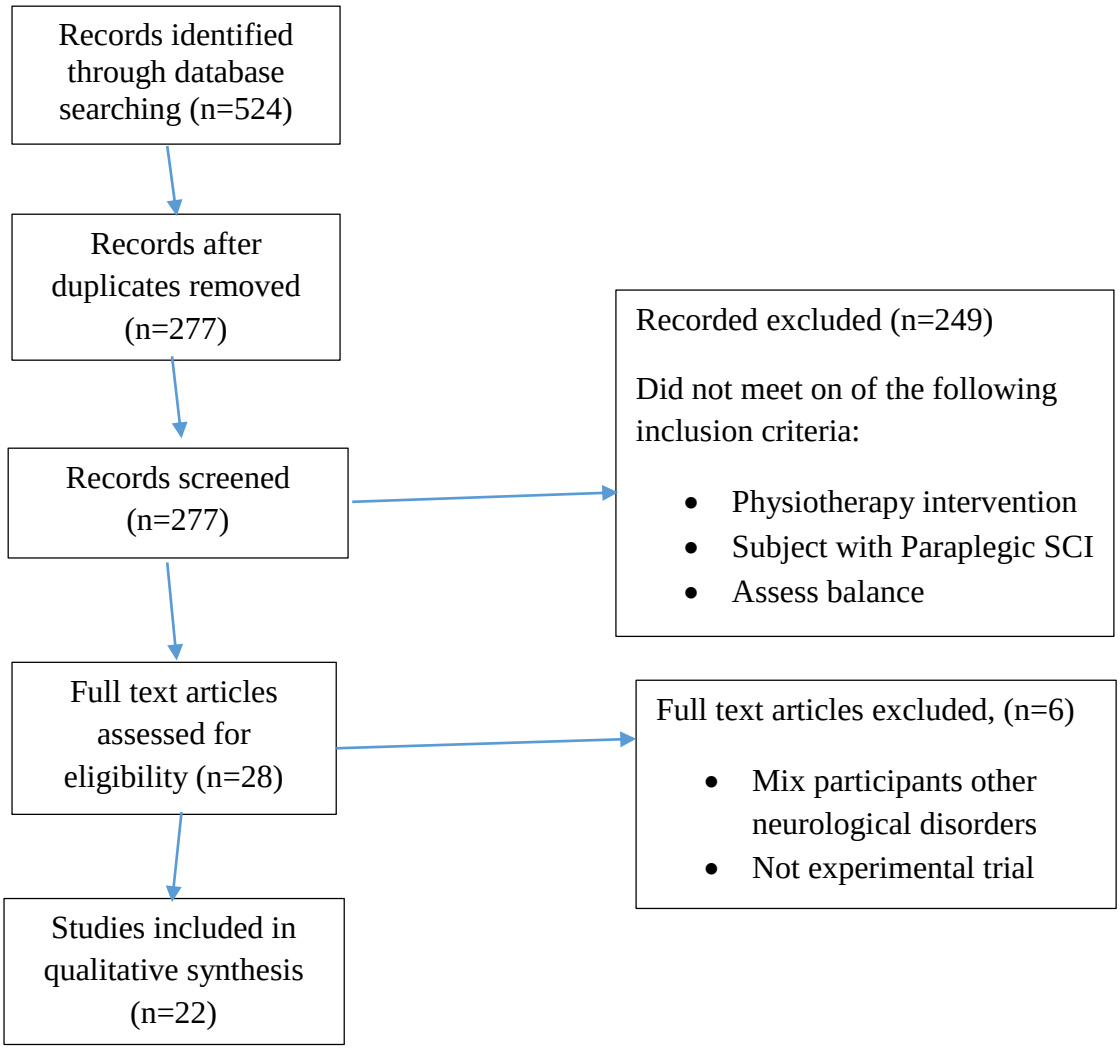

Figure 2: PRISMA Flow Chart

3.4 Eligibility Criteria

The following criteria were used to determine whether or not the study should be included in the evaluation:

Inclusion Criteria:

- Pedro scale score 5 or more.
- Study in the English language.
- Study in which cased are diagnosed as Paraplegic SCI
- Study mentioning the Physiotherapy intervention in Paraplegic SCI.
- Articles found within the time range January (2010-2023).

Exclusion criteria:

- A pilot randomized control trial
- PEDro Scoring <5
- Any study protocol
- Cross-over study
- Clinical trials that do not have a control group.
- Patients have others neurological complications.

3.5 Methods of Literature Review

Search literature using various search engines such as Pubmed, PEDro, Google Scholar, and found more than 1950 articles about this topic. We excessed only 524 articles and from where we took only 28 articles for literature review and selected only 22 RCT for best evidence regarding statements.

3.6 Clinical Question Searched

Pathophysiological changes that take place in the early acute phase of SCI, which can last anywhere from minutes to hours, include vasogenic edoema, microvessel vasospasm, thrombosis, ion imbalance, loss of sodium gradient, release of neurotoxic opioids, inflammation, lipid peroxidation, glutamatergic excitoxicity, cytotoxic edoema, and free radical formation. This phase can last anywhere from minutes to hours. According to Wilson and Fehlings (2011), the sub-acute phase of cellular injury is distinguished by microglial stimulation, macrophage activation, and apoptosis as cellular injury mechanisms. This phase lasts for days to weeks after the damage has occurred. Deep vein thrombosis (DVT) and venous thromboembolic events (VTE) are more likely to occur in individuals who have spinal cord injuries (SCI) because of the neurologic impairment, immobility, intimal damage, and hypercoagulability that these patients encounter. They might accomplish this by clogging the pulmonary arteries, which can lead to a variety of physiologic changes that can be fatal, such as decreased cardiovascular function, right-sided heart failure, and impaired gas exchange (Teasell et al., 2009). These alterations can be caused by pulmonary artery occlusion.

The authors designed the guideline search strategy to investigate the following clinical questions:

1. Acute stage:

   i. What about respiratory conditions?
   ii. What about dermatome, myotome, pressure sore, pain and ROM

2. Stabilization stage:

   i. What about the limb movements?
   ii. What is the conditions of rolling, lying to sitting, sitting balance?

3. Rehabilitation stage:

i. What about the muscle strength, pelvic control, transferring, pain, tone, sit to stand balance, standing balance, gait.

4. Re-integration stage:

i. What about the patient's independency, ADL, self-care.

3.7 Evidence appraisal, Level of evidence, Recommendations

The authors separately evaluated titles and abstracts after the search method was finished using the inclusion and exclusion criteria mentioned earlier. Two authors separately judged the inclusion of titles and abstracts. Also, the included articles were evaluated separately by two authors. The APTA Clinical Practice Guidelines Manual's level of evidence definitions and recommendation grading system were applied. Discrepancies were resolved by consulting a third author. Critical components were retrieved and inserted into an Excel data file. A strong recommendation was issued when there were two or more well-written articles that offered reliable support. A moderate recommendation was made when there was either one well-written article or two articles that were less strong but offered reliable support. A weak recommendation was given when there was contradictory data or low-quality studies. An expert opinion was offered in the lack of supporting evidence. The overall strength of the evidence was determined through a combined analysis of the literature.

3.8 Target Users

Clinicians, allied healthcare professionals, support staff, people with spinal cord injuries and their caregivers, administrators, and policymakers are the target market for the management of Paraplegic Spinal Cord Injury Patients Guideline. Policy makers and administrators are the main users of the section on Components of the Ideal SCI Care System, whereas healthcare professionals, patients, and those who have lived with secondary health conditions, along with their caregivers, are the main users of the section on Management of Secondary Health Conditions. According to a person's spinal cord impairment (neurologic severity of damage, AIS, cord syndrome, and kind of bowel and bladder impairment), the guidelines are meant to describe possible single or multimodal interventions that are evidence-informed.

3.9 Guideline development cycle

The guideline was developed by following some tools like GRADE, AGREE, ADAPTE. The steps involved in the process were as follows:

1. **Establish an expert panel:** The expert panel includes clinicians, individuals with lived experience, program directors, knowledge translation experts, researchers, and administrators and other relevant stakeholders.
2. **Search and retrieval of previously published guidelines**: A systematic scoping review was undertaken for CPGs focused on treatment and evidence-based recommendations in the field of SCI. The following databases were searched: PEDro, Pubmed, and Google Scholar. In addition, indexes and databases that specifically archive clinical guidelines and medical evidence were also included in the search NCCIH Clearinghouse (Patsakos et al., 2021), Clinical Key Trip (Kamdar et al., 2020), Medical Database (Gehring. 2017), DynaMed Plus (Hagen. 2022), Scottish Intercollegiate Guidelines Network (Davies et al., 2019), Guidelines International Network (Patsakos et al., 2021) and Physiotherapy Evidence Database Ratings (Moseleyet al., 2020). The key search terms included ‘spinal cord injury’, ‘spinal cord dysfunction’, ‘paraplegia’, ‘spinal cord impaired’, ‘spinal cord lesion’ (including truncations of these SCI terms) and ‘clinical practice guidelines’. CPGs published between 2010 and 2023 in English, including evidence-based recommendations for adults over 18 years of age were considered for inclusion. Systematic reviews were excluded, and shorter evidence-based documents were excluded, but their reference lists were hand-searched to find any additional clinical practice guidelines for inclusion. The steering committee reviewed the existing SCI guidelines to ensure the content of the guideline would be consistent with planned scope of the CPG and to ensure the extracted recommendations could be adapted to the healthcare context (i.e. health system structure, payor model, available expertise etc.). In addition, steering committee reached out to stakeholder organizations to identify CPGs that were currently in development.
3. **Guideline quality appraisal process using AGREE instrument:** Each eligible CPG was then evaluated individually by two to four appraisers from the expert panel, using the Appraisal of Guidelines for Research and Evaluation II instrument (AGREE II). The AGREE II instrument evaluates the guideline

development process and quality of the guideline across six domains including: (1) scope and purpose, (2) stakeholder involvement, (3) rigor of development, (4) clarity of presentation, (5) applicability, and (6) editorial independence.

4. **Literature search by SCIRE team on prioritized topics:** The search processes were enhanced by systematic searches of the SCI literature conducted by the Spinal Cord Injury Research Evidence (SCIRE) project team to ensure the incorporated recommendations are based on the most current evidence. Evidence statements formulated by the SCIRE project team were added to the synthesized materials prior to convening the entire expert panel to facilitate the formulation of de novo recommendations when there were not existing recommendations, or where the existing guidelines were outdated, insufficient or not relevant to the context.

3.10 Ethical consideration

The whole process of this research project was done by following the Bangladesh Medical Research Council (BMRC) guidelines, Institution Review Board (IRB), Health and World Health Organization (WHO) Research guidelines. The proposal of the dissertation including methodology was approved by Institutional Review Board and obtained permission from the concerned authority of the ethical committee of Bangladesh Health Professions Institute (BHPI).

CHAPTER- IV RESULTS

Physiotherapy Management Protocol

The aim of physiotherapy for patients with spinal cord injury is to improve health-related quality of life. This is achieved by improving patient's ability to participate in activities of daily life. Physiotherapy interventions can help to overcome the barriers to perform maximum functional independency that are directly or indirectly related to motor and sensory loss such as walking, pushing a wheelchair and rolling in bed. During the acute phase, immediately after injury when patients are restricted to bed, the key impairments physiotherapists can prevent or treat are pain, poor respiratory function, loss of joint mobility and weakness. Once patients commence rehabilitation physiotherapists can also address impairments related to poor skill and fitness. Physiotherapists play a vital role in community integration of spinal cord injury patients.

Acute Stage:

This 6- to 12-week bed time starts with the patient's admittance to the hospital and lasts until their neurological condition has stabilized. The purpose of rehabilitation during this time is to stop potential long-term consequences in their tracks (Nas et al., 2015). In patients with full injuries, passive exercises should be performed often to reduce contractures, muscle atrophy, and pain during the acute inpatient period (Hundeshagen et al., 2017). Positioning the joints is essential for maintaining ideal muscle tone and protecting the articular tissue. For placement, sand bags and pillows can be helpful. Plaster splints or stiff orthotics can be used to position the patient if pillows and sandbags are unable to do so. The most common devices for this are ankle foot orthoses, knee-ankle foot orthoses, static ankle foot orthoses, etc. (Shroff et al., 2016).

The most frequent and significant consequence at this time is the development of joint stiffness and contractures. Within a year, 66% of patients (32 % hip, 11 % knee, 40 % foot and ankle) reported having at least one joint contracture (Diong et al., 2012). Intensive passive ROM exercises for paraplegic patients are necessary to keep their lower extremities in line with their damage level. Exercises for the ROM preserve functional ability and prevent contractures. In the absence of spasticity, these exercises

should be performed at least twice daily in a flaccid state (Wang et al., 2015). The areas that require passive EHA protection are determined by the degree of damage, public awareness, and state collaboration. Exercises for shoulder range of motion are crucial to preventing pain at all stages of injury. Exercises that promote passive range of motion should be done to avoid contractures from forming (Harvey et al., 2017).

During the spinal shock stage, muscles are limp. Flaccid muscles make exercise more manageable. Following the period of spinal shock, flaccidity is replaced by spasticity. Despite its benefits, spasticity has a negative impact on transferring, mobility, and everyday living activities (Elbasiouny et al., 2010). The intensity and nature of the various SCI problems have an impact on spasticity, and spasticity should be treated by removing the triggers. Depending on the injury level, isometric, active, or active-assisted truncal exercises ought to be performed in the patient's bed if partial motions are evident (Mersal, 2020). Recent research has demonstrated that early mobilization is crucial for the development of muscle strength as well as the avoidance of pulmonary function deterioration. In order to preserve lung capacity during the acute phase, breathing exercises should be performed, taught, and their significance should be discussed with total or incomplete paraplegic and tetraplegic patients (Berlowitz et al., 2016). Depending on the patient's tolerance, the number of exercises should be kept at its maximum during this time. The patient's family should be included in the rehabilitation team from the first days, and the importance and necessity of the rehabilitation must be shared with patients and their relatives, if the physiotherapist or allied health staff in the clinic are not present or are not sufficient (Jia et al., 2013).

The most crucial aspect of therapy for patients with total paraplegia is to strengthen their upper extremities to the highest possible level during the acute phase. Crutches, swimming, riding an electric bicycle, and walking are suggested as shoulder rotation strengthening activities (Sisto & Evans, 2014). Strong upper extremities are required for independent transfer from bed at the end of the acute episode. For this reason, it is important to start performing resistance and vigorous workouts as soon as possible to strengthen the muscles in the upper extremities (Cratsenberg et al., 2015). Depending on the patient's muscle strength, dumbbells can be used for weight and resistance training while they are lying in bed. If excessive weariness sets in while working out the muscles, electrical stimulation might be a good alternative. According to research

by Nas et al. (2015), shoulder workouts done with elastic bandages are efficient at easing shoulder discomfort.

The patient's position should be altered every 2-3 hours to avoid decubitus sores. The sacrum, ischium, trochanter, and superior aspect of the heel are the areas where decubitus ulcers appear most frequently. Patients should be encouraged to move around and take an active part. Additionally, care should be taken to maintain clean skin and avoid decubitus ulcers (Bhattacharya & Mishra, 2015). Hip flexion contractures may form as a result of prolonged side laying and wheelchair use. Exercises that increase range of motion (ROM) in all directions can help to relieve flexor muscle tightness. The ankle ROM exercises are helpful for maintaining good foot alignment while seated in a wheelchair as well as preventing contractures of the foot (Kruger et al., 2013).

Stabilization Stage:

When the bed interval is over, corsets are employed to stabilize the body and support the spine when the wearer transitions to a sitting position. Thoracic and upper lumbar area fractures are treated using plaster plastic body jackets or hyperextension corsets (Mersal, 2020). To support the fractures at the lower L2 vertebrae, a corset akin to a knight's armor might be more suitable. Corsets of the Knight-Taylor variety restrict trunk flexion and extension but not rotation. To limit mobility in all directions, plaster or plastic body jacket corsets should be worn (Nurbury et al., 2021).

Patients who have spent a lot of time resting in bed are likely to experience orthostatic hypotension. Due to low blood pressure, these individuals may have syncope while sitting and being raised. Patients with this disease can benefit from using a tilt table for 3 minutes each day at a beginning angle of 60 degrees. According to the patient's complaints or condition, the degree is increased (Canosa-Hermida et al., 2018). Standing up straight reflexively raises blood pressure to a safe and stable limit. The patients are ready to transfer and balance and have adapted to sitting and standing. The patient should sit on the edge of the bed three to four times a day once the tilt table has brought them to an upright position, and balance exercises should be performed to help them stay there. For wheelchair use and wheelchair transfer, independent sitting on the edge of the bed is crucial (Barbareschi & Holloway 2020).

The goal of this recovery time should be to educate patients on stability and strength for sitting and transportation. Functional objectives must prepare the patient for actions

like dressing, getting out of bed or a wheelchair, and transfers. Initially, successful bed movements are the objective. Functional activities are performed with ROM and stretching exercises (Taylor-Schroeder et al., 2011). The first few exercises should focus on strengthening the upper extremities, balance, and sitting. In order to shift to the wheelchair, patients who can tolerate sitting can start pushing up using static and dynamic balance training (Gagnon et al., 2016).

Transferring patients out of bed requires the use of wheelchairs, walkers, and crutches. The wheelchair is the most essential piece of equipment for SCI sufferers to be mobile and engage in social activities. In a wheelchair, the user should be able to move around as freely as possible, their skin should be protected, and their posture should be natural (Moahamed, 2020). For injuries at the upper segments, a battery-operated wheelchair is suitable, whereas a manual wheelchair is suggested at the lower levels. Each patient should have a customized wheelchair that meets their height, pelvic width, seat length, backrest, seat, and arm support needs (Jones, 2020).

The severity of the damage and whether it is total or incomplete determine whether splints or other attempts at functional ambulation are successful. Regardless of level, an incomplete SCI patient has the ability to walk (Kozlowski et al., 2015). T12 is regarded as the starting point for the functional ambulation level. To stand and move on the parallel bars, exercises for truncal and pelvic stabilization must be offered. According to Torres and Aperador (2015), the patient could be supported by a posterior shell in the parallel bars at this time as well as begin standing and balance training exercises,.

In order to maintain the stability and integrity of the lower extremity joints in patients following upright standing with a posterior shell, a lengthy, locked knee joint walking device is used. According to Tweedy et al. (2017), the advantages of standing include a decrease in spasticity and the risk of DVT, recovery of bowel and bladder function, prevention of pressure ulcers and osteoporosis, and a decrease in depression. The foundation of functional neuromuscular stimulation (FNS) is the innervation of nerve cells in healthy muscles. FNS activates the muscular fibers in denervated muscles. According to a study, patients with SCI may be able to change their standing postures with little to no effort from their upper bodies by appropriately activating certain

muscles in the trunk and lower extremities, which will also result in an increase in muscle volume (Audu et al., 2011).

Rehabilitation stage:

The accomplishment of independent mobilization for both complete and incomplete paraplegic patients throughout the chronic phase is the most crucial objective. Ambulance use may be for social, domestic, or athletic purposes. For social ambulation, the patient must be able to walk 50 meters without assistance or with help from a device. According to Saunders et al. (2013), people who ambulate domestically can do it either independently or with some support, with some assistance needed, or autonomously. People who walk for exercise require advanced assistance with walking or transferring. Potential for ambulation is influenced by elements such injury severity, age, weight, overall health state, motivation, and spasticity. Patients with a T10 and higher injury can typically be ambulated for activity. Domestic ambulation is possible for individuals with T11-L2 injuries, while social ambulation is possible for people with more proximal injuries (Bryce et al., 2021).

Orthoses, walkers, and crutches are crucial for chronic stage ambulation. Patients who have pelvic control are able to walk outside the parallel bars with an orthosis or crutches. Patients are not need to use a wheelchair if their quadriceps femoris muscle strength is normal and they can walk with elbow crutches and orthotics. A parawalker (hip guidance orthosis) can be used to ambulate patients with full injuries both inside and outside of the home (Arazpour et al., 2013). Walking aids for people with spinal cord injuries are getting lighter and easier to move. But technologically sophisticated gadgets also cost more money. The kind, size, and weight of the patients' equipment can have a big impact on oxygen consumption, energy expenditure, and walking pace. The RGO (reciprocating gait orthosis) is one of them (Asselin et al., 2015).

The patient's excess weight loss, elevated aerobic capacity, and enhanced muscle mass must be maintained for the treatment to be effective. RGO is more complex and expensive than ARGO because it has undergone additional development. Like RGO, ARGO results in an excessive loss of energy. By incorporating functional electrical stimulation into orthoses, hybrid walking aids were developed. With hybrid gadgets, walking is becoming simpler (Chang et al., 2015). The use of robots for teaching is a novel strategy that is evolving quickly. According to a case study, robotic assistance

has improved upper extremity function during the past four weeks. Wrist extensor, finger flexor, and finger abductor manual muscle test scores significantly improve following training (Yozbatiran et al., 2012).

Another study showed that subacute SCI patients' functional outcomes were improved by robotic-assisted gait training employing the locomotor system. Assuring the patient's maximum independence in relation to the severity of their damage, integrating them into society, and emphasizing the value of the family's participation are the most crucial expectations in the chronic phase or phase of returning home (Schwartz et al., 2011).

In order for patients with SCI to engage in autonomous daily activities, home modifications are also crucial. For manual wheelchair access, doors should be 81.5 cm wide; for battery-assist wheelchairs, they should be 86.5 cm wide. Electric switches should be 91.5 cm high. The home must have enough heat and insulation (Mohamed et al., 2022). The height of the door sills must not prevent a wheelchair for patients from passing through, and door handles must be of the "lever-shaped" variety. To make it easier to navigate the wheelchair, the carpets should be pulled up and the ground should be hard. Bathtubs should have handles and be wall-mounted. The patient should be able to reach kitchen tools at their proper height. At the home's entrance, a ramp is required (Williamson, 2012).

Due to the high prevalence of depression in patients (the incidence is around one-third in the first six months), one of the key aspects of this time is repairing the patient's psychological and emotional state. Depression is a problem that needs to be treated rather than a normal process encountered after SCI (Budd et al., 2022). In individuals under the age of 55, suicide is the second most common cause of death after spinal cord injury. 17% of people experience posttraumatic stress disorder, and it typically starts during the first five years. If there is psychotic behavior or depression, a psychiatrist consultation is necessary (Lim et al., 2017).

Re-integration stage

During this phase, patients and patient careers can learn, along with topics such as how patients will go about their everyday lives, including self-care, activities, and other topics.

Maintain close watch over the patient as well as the patient's career in terms of their condition, level of self-exercise, and utilization of local resources as therapeutic agents. Patients and their caregivers should be educated about home exercise. Instruction as well as medical recommendations for patients and caregivers Important determinants of SR and QoL in a selected population of spinal cord injury patients in Greece include employment, education, economic self-sufficiency, time since SCI, pain, age, quadriplegia, and the presence of pressure ulcers. In general, these patients in Greece experience SR (social reintegration) and quality of life that is comparable to that of patients in other European countries, with the exception of community accessibility and the ability to enter the labor market, both of which are worse in Greece than they are in other European countries (Tzanos et al., 2016).

Rehabilitation professionals can help facilitate this process by participating in advocacy activities, partnering with governmental surveillance systems, devising creative outreach models, and actively participating in research to identify and remove barriers to community reintegration. Inspire your patients to get involved in the communities around them. Encourage patients to take part in a variety of social activities such as educational sessions, sports both indoors and outdoors, cultural programs, and cinema displays. Mobility aids should be prescribed, including but not limited to wheelchairs, low wheelchairs, walking frames, elbow crutches, axillary crutches, walking sticks, and any form of special wheelchair, etc. (Haldane et al., 2019).

Intervention parks made investments in new and diversified signage, promotional items, outreach or support for group activities like fitness classes and walking clubs, and various marketing strategies. Additionally, through collaboration with departmental management, various structures for community input were established, and park policy facilitated the implementation and sustainability of these changes (Derose et al., 2014).

Table-2: Therapeutic strategies and results of clinical studies related to the rehabilitation of patients with spinal cord injury

References	Therapeutic strategy/ Intervention	Dose and Description
Xiong et al., 2021	Effect of Specific Acupuncture Therapy Combined with Rehabilitation Training on Incomplete Spinal Cord Injury: A Randomized Clinical Trial	All three groups of patients were treated with routine rehabilitation training, and the necessary symptomatic treatment (for example, catheterization) performed for complications. Both Continuous Acupuncture Treatment (CAT) group and r Intermittent Acupuncture Treatment (IAT) group received acupuncture treatments: 5/week (Monday to Friday) for CAT group and 3/week (Monday, Wednesday, and Friday) for IAT group. ,e treatments lasted for 4 weeks.
MAdhuSMitA et al., 2019	Efficacy of Yoga as an Add-on to Physiotherapy in the Management of Patients with Paraplegia: Randomised Controlled Trial	Participants in the Integrated Yoga and Physiotherapy (IYP) group received 75 minutes (six days/week) of an integrated yoga intervention for one month.
Hitzig et al., 2013	Randomized trial of functional electrical stimulation therapy for walking in incomplete spinal cord injury: effects on quality of life and community participation	Provided the same level of attention and were engaged in a form of physical activity for 45 minutes per session, 3 days a week, for 4 months (48 sessions in total) & intervention group

		received FES stimulation while ambulating on a body weight support treadmill (BWST)
Sadowsky et al., 2013	Lower extremity functional electrical stimulation cycling promotes physical and functional recovery in chronic spinal cord injury	Participants in the FES group had to have participated in FES during cycling for at least 3 months 3 sessions per week.
Karimi et al., 2013	Robotic rehabilitation of spinal cord injury individual	The use of robotic systems for rehabilitation of SCI subjects is increasing, there is not enough evidence to determine the positive and side effects of this system.
Karimi et al., 2013	Functional walking ability of paraplegic patients: comparison of functional electrical stimulation vs mechanical orthoses	The aim of this review article is to compare and evaluate the performance of SCI subjects standing and walking with FES systems and hybrid orthoses based on results reported in published literature.
Van der Scheer et al., 2021	Functional electrical stimulation cycling exercise after spinal cord injury: a systematic review of health and fitness-related outcomes	Three times per week 30 min per session for 12 weeks.
Gangnon et al., 2018	Locomotor training using an overground robotic exoskeleton in long-term manual wheelchair users with a chronic spinal cord injury living in the community: Lessons learned from a feasibility study in	6 to 8-week locomotor training program with a robotic exoskeleton encompassing 18 sessions, three sessions/week; 60 min/session,

	terms of recruitment, attendance, learnability, performance and safety	
Rahimi et al., 2020	A clinical practice guideline for the management of acute spinal cord injury: introduction, rationale, and scope	3 days per week for 24 weeks.
Alashram et al., 2021	Robot-assisted gait training in individuals with spinal cord injury: A systematic review for the clinical effectiveness of Lokomat	3 sessions per week for 8 weeks.
Fang et al., 2020	Effects of Robot-Assisted Gait Training (RAGT) in Individuals with Spinal Cord Injury: A Meta-analysis	The intervention of RAGT was 3 to 5 sessions per week, 30 min to one hour for 4 to 12 weeks in RCTs. The training protocol of non-RCTs was 2 to 5 sessions, 30 min to 90 min for one week to 90 days.
Alashram et al., 2021	Effectiveness of virtual reality on balance ability in individuals with incomplete spinal cord injury: A systematic review	12 sessions spread over 6 weeks, each session was 60 min.

Dijsseldonk et al., 2018	Gait stability training in a virtual environment improves gait and 2 dynamic balance capacity in incomplete spinal cord injury 3 patients	1-h training sessions spread over a 6-week period.
Wiesener et al., 2020	Supporting front crawl swimming in paraplegics using electrical stimulation: a feasibility study	3 times a week for 30-45 min for 4 weeks with a standard FES cycling ergometer.
Sadowsky et al., 2013	Lower extremity functional electrical stimulation cycling promotes physical and functional recovery in chronic spinal cord injury	Intervention group 45–60 minutes at a frequency of three sessions per week for 4 weeks, Controls received non-center-based passive stretching with no active physical therapy.
Lucareli, et al., 2011	Gait analysis following treadmill training with body weight support versus conventional physical therapy: a prospective randomized controlled single blind study	Patient underwent 30 semi-weekly sessions lasting 30 min each for 4 weeks. In all of the sessions, participants were assisted by two physiotherapists who aided the movements of the lower limbs to simulate a normal gait.
Sadeghi et al., 2015	The Effect of Body-Weight-Supported Training Exercises (BWSTT) on Functional Ambulation Profile in Patients with Paraplegic Spinal Cord Injury	BWSTT 4 times per week, 60 minutes each session over a 3 months period and Traditional training consisted of a 10-minute warm up with passive stretch exercises, 45 minutes mobilization exercises.

Fantozzi et al., 2022	Aquatic Therapy after Incomplete Spinal Cord Injury: Gait Initiation Analysis Using Inertial Sensors	Temporal and acceleration-based anticipatory postural adjustment measures were computed and compared between dry-land and water immersion conditions in 10 iSCI patients. Median value of 1.44 s vs. 0.70 s in dry-land conditions.
Noamani et al., 2020	Postural control strategy after incomplete spinal cord injury: effect of sensory inputs on trunk–leg movement coordination	Provides a comprehensive evaluation of the balance control strategy and inter-segment movement coordination for individuals with iSCI compared to age-matched able-bodied individuals during a variety of challenging standing conditions that affected somatosensory and visual inputs. 5 days per week for 4 weeks.
Suganthirababu et al., 2023	Functional electrical stimulation in the management of spastic paraplegia induced by spinal cord injury	The intervention included 45-minute therapy sessions, 3 days per week. The therapy duration was 16 weeks.
Dost et al., 2014	Effects of upper extremity progressive resistance and endurance exercises	A conventional rehabilitation program was applied to the patients for a period of five weeks in the form of daily 90-minute sessions, five days a week. The SCI rehabilitation program included upper extremity exercises, strengthening exercises for body muscles, mobilizations, standing

		exercises, practice of ADLs, and basic training exercises for the wheelchair and transfers.
Hossain et al., 2018	Effectiveness of Gait Training Supported by Overhead Harness in Patients with Spinal Cord Injury (SCI) at Rehabilitation Centre in Bangladesh	Patient participated in a 4 weeks gait training program included a body weight support gait system by an overhead harness 30 min a day, 6 days in a week (further study need to be done in control group compared with partially body weight supported overhead harness gait training approach with large sample size to find out the effectiveness of this walking device).

In this study we show the overall Physiotherapy treatment protocol in different stage of SCI patients during rehabilitation service and beside it we summarized 22 article in which 7 article discuss about Functional electrical stimulation, 2 article about effect of virtual reality, 4 article about robotic assisted gait training and 3 about body weight supported gait training. Other strategic include- aquatic therapy, postural control strategy, yoga and acupuncture therapy. Study provides updated treatment protocol nowadays, some of these are recommendations strong recommendations, some of these moderate, weak recommendations and some of these recommended further study or largely.

Xiong et al. (2021) shown that, the results showed that acupuncture is an effective and safe treatment and that the treatment frequency of 5/per week is better than 3/week. Result may be useful for clinical practice and further research.

Recommendation: Strong recommendations.

In MAdhuSMitA et al. (2019) stated that, improvements in stress resulted in a decrease in inflammation and enhanced emotional stability resulting from better autonomic modulation. Improvement in psychological states resulted in better QoL, and reduction in BMI increased Basal Metabolic Rate (BMR), leading to significant improvement in overall functional independence. One-month Integrated Yoga and Physiotherapy program is more effective than physiotherapy intervention alone, in the management of paraplegia patients.

Recommendation: Strong recommendations.

A study conducted by Hitzig et al. (2013), The present study provides insight into the perceived benefits acquired by participating in an RCT comparing exercises to FES therapy and serves as a model for pinpointing domains of well-being that could be targeted for assessment in future SCI trials.

Recommendation: Effective but need future trials.

FES during cycling in chronic SCI may provide substantial physical integrity benefits, including enhanced neurological and functional performance, increased muscle size and force-generation potential, reduced spasticity, and improved quality of life (Sadowsky et al., 2013).

Recommendation: The current study provides rationale for a prospective randomized clinical trial to evaluate the efficacy of ABRT using FES in people with SCI.

Karimi et al. (2013) showed in a research, although various types of orthotic systems have been developed for paraplegic subjects for walking and rehabilitation, there is not enough research in this regard. It is not easy to determine the therapeutic influence of robotic orthosis on the health status of paraplegic subjects.

Recommendation: There is not enough research in this regard moderate strong.

FES and hybrid orthoses offer considerable potential for restoring standing and walking abilities in persons with SCI. However, improvements in their designs and operation with subsequent objective evaluations are required to demonstrate that the systems enable users to improve their performance over that currently possible with passive, mechanical orthoses (Karimi et al., 2013).

Recommendation: It has been recommended that a large randomized control trial studies will be performed to compare the influence of using FES on the performance of paraplegic subjects.

Van der Scheer et al. (2021) showed that, Current evidence indicates that FES cycling exercise improves lower-body muscle health of adults with SCI, and may increase power output and aerobic fitness. The evidence summarized and appraised in this review can inform the development of the first international, evidence-based clinical practice guidelines for the use of FES cycling exercise in clinical and community settings of adults with SCI.

Recommendation: These clinical practice guidelines help to shape lifelong rehabilitation care plans for the SCI population that fit national and local care contexts and resources.

Gangnon et al. (2018) conducted that, this study confirms that larger clinical trials investigating the effects of a locomotors training program with an over ground robotic exoskeleton are feasible and relatively safe in individuals with complete motor SCI. Moreover, to optimize the recruitment rate and safety in future trials, this study now highlights the need of developing pre-training rehabilitation programs to increase passive lower extremity range of motion and standing tolerance. This study also calls

for the development of clinical practice guidelines targeting fragility fracture risk assessment linked to the use of over ground robotic exoskeletons.

Recommendation: Effects of a locomotors training program with an over ground robotic exoskeleton are feasible and relatively safe in individuals with complete motor SCI.

Advanced weight-bearing mat exercises improve the ability of wheelchair-dependent people with SCI to transfer and attain independence in ADL (Rahimi et al., 2020).

Recommendation: Strong recommendation.

Alashram et al. (2021) stated that, There is strong evidence for the effects of combined robot-assisted gait training (RAGT) 'Lokomat' and conventional physiotherapy on mobility, walking distance, and muscle strength, and moderate evidence for the impacts of RAGT 'Lokomat' alone on mobility, walking distance, and muscle strength. There is moderate evidence for the effects of the Lokomat on range of motion. Lastly, there is insufficient evidence for the effects of the Lokomat on depression, Quality of life, balance, and cardiorespiratory fitness. The Lokomat intervention is not efficient in reducing the lower extremity spasticity post-SCI. The Lokomat training is considered a suitable intervention for medically stable SCI patients with an indication for lower extremities movement.

Recommendation: **S**trong evidence for the effects of combined robot-assisted gait training.

Robot-assisted gait training (RAGT) can improve spasticity and walking ability in people with SCI. The probable reason for no significant change in pain after RAGT is floor effect. RAGT is beneficial for normalizing muscle tone and for improving lower extremity function in people with SCI without causing extra pain (Fang et al., 2020).

Recommendation: People with SCI might experience fear of falling that impeded transferring the improved walking abilities to functional tasks after RAGT.

The initial findings for the effects of VR on balance ability with chronic incomplete SCI patients with C and D on the ASIA scale are promising. In terms of balance, VR training may induce neural plasticity on multiple levels of the central nervous system.

We propose that applying 12–20 sessions of 30 to 60 min of VR may show beneficial effects (Alashram et al., 2021).

Recommendation: Weak recommendation.

Dijsseldonk et al. (2018) showed that, Increased walking speed, stride length, anterior posterior gait stability, and balance confidence suggest that Gait Real-time Analysis Interactive Lab training improves gait and dynamic balance in patients with chronic incomplete SCI.

Recommendation: Moderate recommendation.

Wiesener et al. (2020) stated, Stimulation-assisted swimming seems to be a promising new form of hybrid exercise for SCI people. It is safe to use with reusable silicone electrodes and can be performed independently by experienced paraplegic swimmers except for transfer to water. The study results indicate that swimming speed can be increased by the proposed methods and spasticity can be reduced by prolonged swim sessions with Functional electrical stimulation (FES), Transcutaneous spinal cord stimulation (tSCS). The combination of stimulation with hydrotherapy might be a promising therapy for neurologic rehabilitation in incomplete SCI, stroke or multiples sclerosis patients.

Recommendation: Further studies shall incorporate other neurological disorders and investigate potential benefits of FES and tSCS for gait and balance therapy in water.

Sadowsky et al. (2013) conducted in an article that, Functional electrical stimulation (FES) during cycling in chronic SCI may provide substantial physical integrity benefits, including enhanced neurological and functional performance, increased muscle size and force-generation potential, reduced spasticity, and improved quality of life.

Recommendation: Quality of life and daily function measures were significantly higher in FES group.

Gait training with body weight support was more effective than conventional physiotherapy for improving the spatial–temporal and kinematic gait parameters among patients with incomplete spinal cord injuries (Lucareli, et al., 2011).

Recommendation: Strong recommendation.

Sadeghi et al. (2015) showed that, it seems that Body-Weight-Supported Treadmill Training (BWSTT) is effective in improving walking and movement of patients with spinal cord injury dependent on walking assistance, and most outcome measures showed a trend toward improvement in gait training. BWSTT modality was goal-directed and intensive. The therapists could choose BWSTT based on the patients' preferences and availability of equipment and resources.

Recommendation: This study confirms that gait training has benefits for recovery of incomplete spinal cord injury.

Fantozzi et al. (2022) said that, an easy-to-use protocol using four inertial measurement unit (IMU) was implemented to evaluate gait initiation during aquatic therapy sessions in incomplete SCI patients. The temporal and acceleration parameters estimated routinely can evaluate the execution of the motor task performed in dry-land and water conditions, giving important information regarding different control strategies adopted in a different environment.

Recommendation: Proposed to use buoyant supports for the upper limbs.

According to Noamani et al. (2020), trunk–leg movement coordination assessment showed sensitivity, discriminatory ability, and excel- lent test–retest reliability to identify changes in balance control strategy post-incomplete SCI and due to altered sensory inputs. Trunk–leg movement coordination assessment using wearable sensors can be used for objective outcome evaluation of rehabilitative interventions on postural control post-incomplete SCI.

Recommendation: It could provide clinicians with an insight into how adaptive movement strategies affect postural control post-iSCI.

Suganthirababu et al. (2023) showed that, effectiveness of functional electrical stimulation allows to apply it as an adjunct to the standard treatments available with more priority.

Recommendation: Recommend future studies in a large scale to explore the effectiveness of FES in improving the functional mobilization of patients with paraplegia.

Dost et al. (2014) showed, both progressive resistance exercises (PRE) and endurance exercises (EE) can increase the independence for ADLs regardless of lesion levels of SCI patients. Muscle strength increase is also demonstrated.

Recommendation: Strong recommendations this was effective need more sample size for further study.

Hossain et al. (2018) showed that, the study found that gait training supported by overhead harness is effective for the patients of SCI to improve their gait quality in perspective of walking speed and balance.

Recommendation: Further study need to be done in control group compared with partially body weight supported overhead harness gait training approach with large sample size to find out the effectiveness of this walking device.

CHAPTER-V DISCUSSION

To the best of our knowledge, we made an effort to create SCI clinical practice guidelines utilizing the exacting, widely acknowledged consensus approach described in GRADE, ADAPTE, and AGREE II. The expert group believes that by giving people with SCI a foundation for promotion, the guidelines will have significant ramifications for consumers, physicians, and legislators. The recommendations will also serve as a framework for ongoing research and a standard for monitoring and surveillance.

Practically speaking, the publication of the guidelines may cause service providers to change how they advise and deliver exercise to individuals with SCI. For instance, exercise programmers and community fitness facilities may now be more willing to offer treatment programs to persons with disabilities since they have knowledge of how to prescribe treatment to people with SCI. In a similar way, the recommendations made by the guidelines and their companion guide (which is still under preparation) will dispel any current informational obstacles.

Evidence-based recommendations could also serve as the basis for making a case for universal insurance coverage of the costs associated with following these recommendations for individuals with SCI. Strategic distribution of the guidelines and supporting materials to influential policy and decision-makers is necessary for their application in this situation. Additionally, the instructions must be provided in such a way that they cannot be used to reduce the coverage of insurance policies that cover more activity than is advised.

In terms of research, the guidelines offer a prescription for a standard treatment procedure that may be used in treatment intervention studies as well as a standard by which to compare the effects of different activity levels. The research on SCI treatment is tainted by inconsistent and diverse exercise procedures, making it challenging to compare the efficacy of the treatment across studies. Researchers are encouraged to make use of the recommendations while creating their therapy procedures in order to start addressing this constraint. Furthermore, these recommendations offer a foundation for developing significant research questions about identifying the secondary health advantages (for instance, risk of chronic disease) for the SCI community.

CHAPTER-VI LIMITATIONS AND RECOMENDATIONS

There was frequently a lack of coherence between clearly specified educational treatments, patient-centered language, and instructional components. Numerous theoretical frameworks were used in studies to guide exercise treatments. The synthesis of best practice recommendations was difficult due to inconsistent reporting of intervention data, such as frequency, duration, and combinations of therapeutic interventions used. It is challenging to examine the effects of exercise in isolation because different treatment groups were typically used in exercise-based intervention trials. Additionally, numerous co-interventions are used in most intervention trials. It was difficult to assess the effects of any one intervention due to co-interventions such medication use, interaction with additional healthcare professionals, participation in other therapies, and physical exercise. Future intervention studies must include longer follow-up (past the end of the intervention), compliance mechanisms, and offered reasons during or after the intervention.

This is in line with the SCI evidence's nature, the population's varied impairments, the relatively low incidence and prevalence, and the difficulty of researching sophisticated therapies in this group. The process used to create the SCI Practice Guidelines had many advantages, including preventing the SCIP group from duplicating the excellent work of other guideline groups and enabling the expert panel members to adopt the recommendations for inclusion that were of the highest caliber.

In a nutshell, the following factors will determine whether SCIP Guideline proposals are given priority for revision and dissemination: The decision-making process prioritizes the recommendation, which may be impacted by rising rates of morbidity and death or by the need for urgent interventions or treatments. Emerging evidence has a moderate-to-high possibility of raising the effectiveness of a specific intervention, and the discipline is actively researching the subject at hand.

CHAPTER-VII CONCLUSION

The guidelines in the SCI Guideline were established using a methodical and exacting approach that evaluated previously released, carefully developed CPGs and recently published studies concentrating on various treatment procedures centered on managing spinal cord injuries. The evaluation and recommendation of high-quality studies for the creation of the CPGs. The suggestions apply to the treatment of people with SCI throughout their lives, from the time of the injury to healthy aging in the community. The recommendations in the guidelines are meant to help clinicians, managers, and policymakers working in interdisciplinary teams give people with SCI evidence-based multidisciplinary care in the Bangladeshi healthcare system.

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

Ref: CRP-BHPI/IRB/732

Date: 29.10.2022

To
Sulakshna Shyama Biswas
M.Sc. in Physiotherapy
Session 2019-2020, DU Reg No. 3547
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal **"Clinical Practice Guideline of Physiotherapy Intervention for Lower Limb on Spinal Cord Injury"** by ethics committee.

Dear Sulakshna Shyama Biswas,
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	Physiotherapy Evidence Database (PEDro)

The purpose of the study is to review literatures and recommend to help establish clinical practice guideline by ensuring the current and available evidence for the lower limb rehabilitation of spinal cord injury survivors.Should there any interpretation, typo, spelling, and grammatical mistake in the title, it is the responsibility of investigator. Since the study involves electronic data base search strategy through Pubmed and Physiotherapy Evidence Database (PEDro) and the articles will search by using the Boolean operator. The members of the Ethics committee approved the study to be conducted in the presented form at the meeting held at 09.00 AM on 24th September 2022 at BHPI.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring during the study, any revision in the protocol 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
Associate Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

The Chairman
Institutional Review Board (IRB),
Bangladesh Health Professional Institute (BHPI),
Centre for the Rehabilitation of the Paralysed (CRP),
Savar, Dhaka-1343, Bangladesh

Subject: Application for review and ethical approval.

Dear Sir,
With due respect, I am Sulakshna Shyama Biswas, a student of Part - II of M. Sc. in Physiotherapy program at Bangladesh Health Professional Institute (BHPI), an academic institute of Centre for the Rehabilitation of the Paralysed (CRP) under the Faculty of Medicine, University of Dhaka. As per the course curriculum, I have to conduct a study entitled **"Clinical Practice Guideline of Physiotherapy Intervention for Lower Limb on Spinal Cord Injury"**under the most honorable supervisor Md. Obaidul Haque, Professor & Vice Principal, Bangladesh Health Professional Institute (BHPI).

The purpose of the study is to form a series of recommended physiotherapy interventions by ensuring the current and available evidence for the lower limb rehabilitation of spinal cord injury survivors. The study involves electronic data base search strategy through Pubmed and Physiotherapy Evidence Database (PEDro) and the articles will search by using the Boolean operator.

Therefore, I look forward to having your kind approval for the thesis proposal and to start thethesis. I can also assure you that I will maintain all the requirements for study.

Sincerely,

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Recommendation from the thesis supervisor

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