**FINAL TERM ASSIGNMENT PAPER**

**SUBJECT : NEUROLOGICAL PHYSICAL THERAPY**

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**Question 1:**

**Answer**

**Spinal cord injury**

Spinal cord injury occurs when there is any damage to the spinal cord that blocks communication between the brain and the body. After a spinal cord injury, a person’s sensory, motor and reflex messages are affected and may not be able to get past the damage in the spinal cord. In general, the higher on the spinal cord the injury occurs, the more dysfunction the person will experience. Injuries are referred to as complete or incomplete, based on whether any movement and sensation occurs at or below the level of injury.

The American Spinal Injury Association (ASIA) established a [grading system](https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Hope-Through-Research/Spinal-Cord-Injury-Hope-Through-Research#3233_7) called the ASIA Impairment Scale to describe the severity of spinal cord injuries. The system uses the letters A through E and is as follows:

* **ASIA A:** complete spinal cord injury with no sensory or motor function
* **ASIA B:** incomplete sensory function with complete loss of motor function
* **ASIA C:** incomplete motor function with some movement, but fewer than half of the muscle groups can lift against gravity with a full range of motion
* **ASIA D:** incomplete motor function with more than half of the muscle groups able to lift against gravity
* **ASIA E:** normal

**Complete Spinal Cord Injury:**

When the spinal cord is compressed or severed completely which affects the ability of the brain to communicate motor and sensory functions to the body below the level of injury. Symptoms of a complete spinal cord injury could be loss of sensation below the level of injury, complete loss of function below the level of injury, unable to control bowel or bladder, and depending on how high the level of injury is a person could have difficulty breathing.

**Incomplete Spinal Cord Injury:**

when the spinal cord is compressed or injured but the brain still has the ability to send signals below the site of injury. The effects of this type of injury vary. Symptoms of an incomplete spinal cord injury could be retaining some sensation below the site of injury that comes and goes, being able to move some muscles below the level of injury or pain having chronic pain below the level of injury. For example, a patient recovering from a spinal cord injury from an infection may regain a large about of function back.

For example

* Anterior Cord
* Posterior Cord
* Central Cord Syndrome
* Brown-Sequard Syndrome
* Cauda Equine Lesion

**Question 2:**

**Answer**

**Anterior cord syndrome:**

 Injury to the front of the spinal cord, interfering with sensations of touch, pain, and temperature. Most anterior cord injury survivors can recover some movement.

**Causes**

* Direct anterior [Cord Compression](https://wikem.org/wiki/Cord_Compression) (e.g. disc protrusion, posterior [abdominal aortic aneurysm](https://wikem.org/wiki/Abdominal_aortic_aneurysm), mass)
* Hyperflexion injury of cervical spine
* Thrombosis of anterior spinal artery

**Signs & Symptoms**

* [Paraplegia](https://wikem.org/wiki/Weakness) below level of lesion (corticospinal)
* [Loss of pain](https://wikem.org/wiki/Numbness)/temperature (lateral spinothalamic)
* Autonomic dysfunction, [orthostasis](https://wikem.org/wiki/Hypotension)
* Bowel, bladder, sexual dysfunction
* Preservation of modalities carried by dorsal columns i.e. vibration, proprioception, 2-point discrimination

**Central cord syndrome:**

When the center of the cord is injured loss of sensation is common, and survivors rarely recover movement in their arms, but movement in the legs may be possible.

**Causes**

* CCS usually occurs in people with existing arthritis changes in the bones of the neck.
* In a car accident, the spinal cord can be squeezed. There is usually no obvious break or fracture in the bones of the neck and spine may be stable.
* When the spinal cord is squashed, bruising, bleeding and swelling can occur, particularly in the center or central portion of the spinal cord

**Signs & Symptoms**

* Patients typically complain of weakness in the upper extremities (arms) and less severe weakness of the lower extremities (legs).
* weakness may result in difficulty with every-day tasks, such as doing up buttons, writing or even walking.
* Patients may also note a lack of sensation and difficulty urinating.
* Depending on the severity of the event that triggered the onset of symptoms, patients may also complain of neck pain.

**Posterior cord syndrome:**

Injuries to the back of the spinal cord posterior injury survivors maintain good posture and muscle tone, as well as some movement but struggle with poor coordination.

**Causes**

* Trauma to the spinal cord, such as neck [hyper flexion](https://en.wikipedia.org/wiki/Hyperflexion) injuries are often the result of car accidents or sports-related injuries.
* In such injuries, posterior dislocations and extensions occur without the rupture of ligaments. This blunt trauma may be further complicated with subsequent disc compression.
* In addition to these complications, transient [ischemic](https://en.wikipedia.org/wiki/Ischemia) attacks could occur in the spinal cord during spinal artery occlusion

**Signs & Symptoms**

* Symptoms of posterior spinal artery infarcts include ipsilateral loss of [proprioceptive sensation](https://en.wikipedia.org/wiki/Proprioception), fine touch, pressure, and vibration below the lesion; deep tendon [a reflexia](https://en.wikipedia.org/wiki/Areflexia); and in severe circumstances, complete paralysis below the portion of the spinal cord affected

**Brown-Sequard syndrome:**

Produces an a-symmetrical injury affecting only one side of the spinal cord allowing movement and sensation to continue on one side of the body but not the other.

**Causes**

This syndrome is often a consequence of a traumatic injury by a knife or gunshot to the spine or neck. In many cases, however, it is caused by, or is the result of, other spinal disorders such as cervical spondylosis, arachnoid cyst or epidural hematomas. Brown-Séquard syndrome may also accompany bacterial or viral infections. Blunt traumas, such as occur in a fall or automobile accident, on rare occasions may be the cause of the Brown-Séquard syndrome.

**Signs & Symptoms**

* . First symptoms are usually loss of the sensations of pain and temperature, often below the area of the trauma.
* There may also be loss of bladder and bowel control.
* Weakness and degeneration (atrophy) of muscles in the affected area may occur.
* Paralysis on the same side as that of the wound often occurs.
* Paralysis may be permanent if diagnosis is delayed.

**Cauda equina lesion:**

Damages the nerves between the first and second lumbar regions of the spine, resulting in a loss of sensation, but not a loss of movement . It may be possible to repair or regenerate some nerves to improve function.

**Causes**

* Spinal lesions and tumors
* Spinal infections or inflammation
* Lumbar spinal stenosis
* Violent injuries to the lower back (gunshots, falls, auto accidents)
* Birth abnormalities
* Spinal arteriovenous malformations (AVMs)
* Spinal hemorrhages (subarachnoid, subdural, epidural)
* Postoperative lumbar spine surgery complications
* Spinal anesthesia

**Signs & Symptoms**

* Motor weakness, sensory loss, or pain in one, or more commonly both legs
* Saddle anesthesia (unable to feel anything in the body areas that sit on a saddle)
* Recent onset of bladder dysfunction (such as urinary retention or incontinence)
* Recent onset of bowel incontinence
* Sensory abnormalities in the bladder or rectum
* Recent onset of sexual dysfunction
* A loss of reflexes in the extremities

**Question 3:**

**Answer**

**Cranial nerves**

The cranial nerves are a set of twelve nerves that originate in the brain. Each has a different function for sense or movement. The functions of the cranial nerves are sensory, motor, or both: Sensory cranial nerves help a person to see, smell, and hear. Motor cranial nerves help control muscle movements in the head and neck. Each nerve has a name that reflects its function and a number according to its location in the brain. Scientists use Roman numerals from I–XII to label the cranial nerves in the brain

## I. Olfactory nerve

The [olfactory nerve](https://teachmeanatomy.info/head/cranial-nerves/olfactory-cni/) transmits information to the brain regarding a person’s sense of smell.

## II. Optic nerve

The [optic nerve](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2766286/) transmits information to the brain regarding a person’s vision.

## III. Oculomotor nerve

The [oculomotor nerve](https://teachmeanatomy.info/head/cranial-nerves/oculomotor/) helps control muscle movements of the eyes.

## IV. Trochlear nerve

The [trochlear nerve](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2801485/) is also involved in eye movement.

## V. Trigeminal nerve

The [trigeminal nerve](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2848459/) is the largest cranial nerve and has both motor and sensory functions.

Its motor functions help a person to chew and clench the teeth and gives sensation to muscles in the tympanic membrane of the ear.

Its sensory division has three parts that connect to sensory receptor sites on the face. The ophthalmic part gives sensation to parts of the eyes, including the cornea, mucosa in the nose, and skin on the nose, the eyelid, and the forehead. The maxillary part gives sensation to the middle third of the face, side of the nose, upper teeth, and lower eyelid. The mandibular part gives sensation to the lower third of the face, the tongue, mucosa in the mouth, and lower teeth.

## VI. Abducens nerve

The [abducens nerve](https://teachmeanatomy.info/head/cranial-nerves/abducens-nerve/) also helps control eye movements.

**VII. Facial nerve**

The [facial nerve](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2848459/) also has both motor and sensory functions.

The facial nerve is made up of four nuclei that serve different functions: movement of muscles that produce facial expression movement of the lacrimal, submaxillary, and submandibular glands the sensation of the external ear the sensation of taste

## VIII. Vestibulocochlear nerve

The [vestibulocochlear nerve](https://teachmeanatomy.info/head/cranial-nerves/vestibulocochlear/) is involved with a person’s hearing and balance.

The vestibulocochlear nerve contains two components. The vestibular nerve helps the body sense changes in the position of the head with regard to gravity. The body uses this information to maintain balance. The cochlear nerve helps with hearing. Specialized inner hair cells and the basilar membrane vibrate in response to sounds and determine the frequency and magnitude of the sound.

## IX. Glossopharyngeal nerve

The [glossopharyngeal nerve](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2882282/) possesses both motor and sensory functions. The sensory function receives information from the throat, tonsils, middle ear, and back of the tongue. It is also involved with the sensation of taste for the back of the tongue. The motor division provides movement to the stylopharyngeus, which is a muscle that allows the throat to shorten and widen.

## X. Vagus nerve

The [vagus nerve](https://teachmeanatomy.info/head/cranial-nerves/vagus-nerve-cn-x/) has a range of functions, providing motor, sensory, and parasympathetic functions.

The sensory part provides sensation to the outer part of the ear, the throat, the heart, abdominal organs. It also plays a role in taste sensation. The motor part provides movement to the throat and soft palate. The parasympathetic function regulates heart rhythm and innervates the smooth muscles in the airway, lungs, and gastrointestinal tract.

**XI. Accessory nerve**

The [accessory nerve](https://teachmeanatomy.info/head/cranial-nerves/accessory/) provides motor function to some muscles in the neck. It controls the sternocleidomastoid and trapezius muscles that allow a person to rotate, extend, and flex the neck and shoulders.

## XII. Hypoglossal nerve

The [hypoglossal nerve](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2882282/) is a motor nerve that supplies the tongue muscles.

**Effectiveness of MRP**

Patients will learn more easily in familiar everyday situations that have meaning. This kind of environment will facilitate retrieval of previously stored functions. This type of treatment will help:

* Increase [muscle strength](http://physio.co.uk/what-we-treat/neurological/symptoms/muscular-problems/weakness.php)
* Stretch [tight muscles](http://physio.co.uk/what-we-treat/neurological/symptoms/muscular-problems/spasms.php) and prevent [soft tissue contractures](http://physio.co.uk/what-we-treat/neurological/symptoms/muscular-problems/soft-tissue-contractures.php)
* Improve cognitive function
* Regain motor control
* Relearn function of affected side
* Improve functional tasks such as sit to stand, walking, reaching and grasping
* Improve the sequence of functional activities in order to achieve a specific aim.
* Improve posture
* Increase independence

**Question 4:**

**Answer**

**Balance and coordination**

Coordination is the capacity to move through a complex set of movements. Balance and coordination depend on the interaction of multiple body organs and systems including the eyes, ears, brain and nervous system, cardiovascular system, and muscles. Tests or examination of any or all of these organs or systems may be necessary to determine the causes of loss of balance, dizziness, or the inability to coordinate movement or activities. Purpose Tests of balance and coordination, and the examination of the organs and systems that influence balance and coordination

**Rapidly Alternating Movement Evaluation**

Ask the patient to place their hands on their thighs and then rapidly turn their hands over and lift them off their thighs. Once the patient understands this movement, tell them to repeat it rapidly for 10 seconds. Normally this is possible without difficulty. This is considered a rapidly alternating movement.

**Point-to-Point Movement Evaluation**

Next, ask the patient to extend their index finger and touch their nose, and then touch the examiner's outstretched finger with the same finger. Ask the patient to go back and forth between touching their nose and examiner's finger. Once this is done correctly a few times at a moderate cadence, ask the patient to continue with their eyes closed. Normally this movement remains accurate when the eyes are closed. Repeat and compare to the other hand.

**Rhomberg Test**

The Romberg test by having the patient stand still with their heels together . Ask the patient to remain still and close their eyes. If the patient loses their balance, the test is positive.

#### One-legged standing (OLS)

This test] measures the ability to maintain balance while standing still on one leg on a firm floor, with shoes off, eyes open, and crossed arms gripping the shoulders, for 20 seconds.

#### Full turn (FT)

The 360° (FT) turn test measures the ability to perform a full turn, with shoes off. The test depends on successful integration between the vestibular–proprioceptive and visual systems

**MRP**

A **motor relearning program** is a rehabilitation training focusing on **motor** function recovery post central nervous system injury, and is based on theories of biomechanics, sports science, neuroscience and cognitive psychology.

The organization and production of movement is a complex problem, so the study of motor control has been approached from a wide range of disciplines, including psychology, cognitive science, biomechanics and neuroscience. The control of human movement has been described in many different ways with many different models of Motor Control put forward throughout the 19th & 20th Centuries. Motor Control Theories include the production of reflexive, automatic, adaptive, and voluntary movements and the performance of efficient, coordinated, goal-directed movement patterns which involve multiple body systems (input, output, and central processing) and multiple levels within the nervous system. Within the field of Neurology, many textbooks and researcher recommend adoption of a systems model of Motor Control incorporating neurophysiology, biomechanics and motor learning principles which also considers learning solutions based on the interaction between the patient, the task and the environment. As a therapist, it is these key areas that we need to be aware of when planning our interventions. As therapists, we can change the environment, or the task in such a way as to enable our patients to achieve their goals.

**Question 5:**

**Answer**

Proprioceptive Neuromuscular Facilitation (PNF)

Proprioceptive Neuromuscular Facilitation (PNF) is a more advanced form of flexibility training, which involves both the stretching and contracting of the muscle group being targeted. PNF stretching is one of the most effective forms of stretching for improving flexibility and increasing range of motion. PNF stretching was originally developed as a form of rehabilitation, and to that effect it is very effective. It is also excellent for targeting specific muscle groups, and as well as increasing flexibility, it also improves muscular strength.

**PNF irradiation**

The proprioceptive neuromuscular facilitation (PNF) is a physiotherapeutic concept based on muscle and joint proprioceptive stimulation. Among its principles, the irradiation is the reaction of the distinct regional muscle contractions to the position of the application of the motions.

**PNF Slow Reversal**

Slow Reversal: isotonic contraction of the agonist followed immediately by an isotonic contraction of the antagonist. ... Slow reversal-hold-relax: isotonic contraction of the antagonist followed by an isometric contraction of the agonist followed by a relaxation phase.

**PNF Rhythmic stabilization**

Rhythmic stabilization (RS) is one of the original techniques of proprioceptive neuromuscular facilitation (PNF). RS comprises alternating isometric contractions against resistance without movement intention RS comprises alternating isometric contractions against resistance without movement intention. Its various objectives include increasing the range of motion passively and actively; improving muscle strength, balance, and stability; and reducing pain .The technique involves the use of isometric contraction with the alternating activity of agonist and antagonist muscles without the loss of tension

**PNF Contract and hold relax**

Another common PNF technique is the contract-relax stretch . It is almost identical to hold-relax, except that instead of contracting the muscle without moving, the muscle is contracted while moving. This is sometimes called isotonic stretching. It is almost identical to hold-relax, except that instead of contracting the muscle without moving, the muscle is contracted while moving. This is sometimes called isotonic stretching. For example, in a [hamstring stretch](https://www.youtube.com/watch?v=HQ_eNBvWjQo&list=UU9y8Qz1fy95kAuI6njKFOpQ&index=5), this could mean a trainer provides resistance as an athlete contracts the muscle and pushes the leg down to the floor.