Case report

Effects of functional Proprioceptive Neuromuscular Facilitation with Mental Practice to improve activities of daily living in Syringomyelia Patient - A Case Report.

ABSTARCT :

Background: Syringomyelia is a rare disorder in which a syrinx is formed in the spinal cord and it expands over the time, damaging the entire spinal cord. It shows low prevalence and is difficult to diagnose. Syringomyelia is a physically disabling condition and its symptoms are profoundly similar to that of spinal cord injury (SCI). Since it is a rare disorder, there is lack of literature about the effects of various physiotherapy techniques in syringomyelia patients. **Objective:** The aim is to determine the effects of functional Proprioceptive Neuromuscular Facilitation (PNF) with Mental Practice to improve activities of daily living in syringomyelia patient. **Case report:** We report the case of a 25 year old female presenting with history of fever and chills for a month followed by *convulsions and loss* of sensations and muscle power 1/5 in both lower limbs below the trunk. The condition was managed by functional PNF techniques along with mental practice. **Conclusion:** PNF with Mental Practice is effective to improve activities of daily living in syringomyelia patient**.**

Key words: Gait, Physiotherapy, Postural balance, Proprioceptive Neuromuscular Facilitation (PNF) stretching, Syringomyelia.

1. INTRODUCTION

Syringomyelia is a disorder in which a fluid-filled cyst forms within the spinal cord. This cyst, called a syrinx, expands and elongates over time, damaging the spinal cord [1]. The prevalence of syringomyelia is about 8.4 cases per 100,000 populations, common in men than women. Syringomyelia can be idiopathic (primary) or secondary to trauma. Oldfield's theory states that, downward movement of cerebellar tonsils during systole creates a piston effect in the spinal subarachnoid space which forces cerebrospinal fluid (CSF) to pass between perivascular and interstitial spaces to form a syrinx. This increases intramedullary pressure that compresses long tracts, neurons, and microcirculation leading to neurological dysfunction [2]. Different symptoms like progressive weakness, pain over back, shoulders, arms, legs, loss of temperature sensation, facial pain and numbness, loss of pain sensation, difficulty in walking, bowel and bladder dysfunction and increased curvatures of spine are seen in such patients. The extent of syrinx cavity can be visualized in MRI scan [3]. At early stage, syrinx decompression can potentially reverse the symptoms due to raised intramedullary pressure [4]. Patient's functional status and physical capacity depends on underlying cause, magnitude of neurological dysfunction, and location and extension of syrinx [5]. Prognosis of symptoms associated with syrinx like numbness likely to get improve post-surgery whereas burning pain and weakness in extremities is most likely to be permanent and irreversible [6]. Mental practice is a recently emerged technique that causes

repetitive mental simulation to execute a target movement in absence of bodily activities[7]. Proprioceptive Neuromuscular Facilitation (PNF) techniques involve functional diagonal patterns with repetitive resistance and stretch to facilitate normal movement [8]. The present case report aims to determine the effects of functional PNF with Mental Practice to improve activities of daily living in syringomyelia patient.

2. CASE REPORT

A 25 year old female was apparently alright 6 years back when she encountered with repeated episodes of fever and chills a month. She neglected her condition and self-administered paracetamol of 650mg. After a month, there were 3 episodes of convulsion that lasted for 2 hours. Patient was immediately taken to tertiary health care hospital and admitted to Intensive Care Unit. Patient regained consciousness after an hour and complained for loss of sensations in both her lower limbs. Patient was scheduled for radiological investigation where brain MRI scan revealed mild grade of hydrocephalus likely to be associated with basal meningitis. MRI of spine showed diffused and extensive meningeal enhancement involving almost entire spinal canal. Cerebrospinal fluid (CSF) showed lymphocytosis with raised adenosine deaminase (ADA) level to 119U/L. Sign and symptoms along with elevated ADA and MRI impression suggested the diagnosis of tuberculous myelitis with arachnoiditis. Following medication were started; C-Rcinex, T-Moxi 400, T ethambutol, T-Levipil, T Domsal, T-pan, T-Lioresal and T-Wysolone . Preventive physiotherapy intervention was started. After a week patient was shifted to medicine ward. In this duration patient gradually regained altered sensation in both lower limb and flicker contraction of muscles in left lower limb. Manual Muscle Testing (MMT) of left and right lower limb were 1/5 and 0/5 respectively. Repeated CSF examination showed elevated ADA level to 208mg/dl and reduced glucose level to 29mg/dl. Patient was discharged after a month and was recommended to continue physiotherapy and advised to undergo MRI scan every 6 months. A year after discharge patient was asymptomatic so she decided to discontinue her medicines. Patient underwent regular physiotherapy sessions for 2 years. In October 2015, six monthly MRI scan of brain revealed extensive meningeal enhancement and marked reduction in ventricular size. MRI dorsal spine scan showed ill-defined patchy T1 hyposensitivity extending from D1 to D10 and patient was diagnosed with syringomyelia level D1-10. No medical management was initiated due to poor financial status of the patient and eventually patient discontinued her physiotherapy sessions. In 2017, patient experienced increased burning sensation, numbness and inability to move both her lower limbs. MRI of spine revealed long segment cavitation of cervicodorsal cord that extended from C1 to upper margin of D12. Patient was started on her previous medication and was strictly advised for intense physiotherapy.

On day 1 at our neuro-rehabilitation centre, patient complained of inability to walk, perform stair climbing, outdoor and indoor transfer and had maximum dependency for activities of daily living. On physical examination, Active Range of Motion (AROM) of hip, knee and ankle muscles were not possible. During passive ROM, there was mark increased in lower limb muscle tone. Modified Ashworth Scale (MAS) readings for bilateral hip extensors, knee extensors and ankle planter flexors were 3/4. MMT of both lower limbs was 0/5. Observational Gait analysis stated that patient used walker for ambulation and relied on her upper body strength for stabilizing while walking. Also there was an anatomical lock of knee joint causing hyperextension to avoid the frequent buckling on weight bearing. On sensory examination, there were altered touch and pain sensation till level L1 on both limbs and

absent from level L2-S1. Physiotherapy intervention since day 1 included general warm up exercises like passive movements, stretching of lower limb muscles with active mobility of upper limb and trunk for 15 repetitions x 2 sets, Modified cobra pose and push up hold for 10 counts 15 repetitions, 2 sets. Mat activities like bridging, quadruped position, bed mobility training, active assisted crawling, kneeling position, supported kneel walk, diagonal reach outs, functional training for sit to stand using walker support and passive fixation of knee. Functional PNF diagonal lower limb pattern like symmetrical bilateral D1 flexion-extension and D2 flexion extension along with pelvic and scapular PNF pattern for 20 repetitions, 2 sets were given. Endurance training was given using static ergometer wherein straps were used to stabilise mid-tibia and foot over the pedal to avoid knee joint from failing. It started with passive cycling and progressed to active assisted for 30 minutes. Gait PNF training was used to gain passive stability on standing which was progressed to segmental walking phase training using parallel bars for 30 minutes. Throughout each segment of treatment, mental practice was carried out. Patient was asked to visualise and perform all the movements in their mind with high level concentration and repeat the given task multiple times approximately 180 seconds prior to actual physical performance of the task. Regular treatment was given for 70 weeks after which weekly follow up was conducted for next 7 weeks. On the last session of follow up the patient was re-assessed and given planned monthly home programme with specified goals in order to motivate her for monthly physical target as she moved out of town thereafter.

Table1: Pre-post intervention score of Manual muscle test scores, Trunk impairment score, Functional Independence Measure Scale, Fatigue severity score and 6 minute walk test.

Manual Muscle Testing (MMT)	**DAY1**		**DAY 540**	
	Right	**Left**	**Right**	**Left**
Hip flexor	0/5	0/5	2/5	3/5
Hip extensors	0/5	0/5	3/5	3/5
Hip abductors	0/5	0/5	2/5	3/5
Hip adductors	0/5	0/5	2/5	3/5
Hip internal rotators	0/5	0/5	3/5	3/5
Hip external rotators	0/5	0/5	3/5	3/5
Knee flexors	0/5	0/5	3/5	3/5
Knee extensors	0/5	0/5	3/5	3/5
Ankle dorsiflexors	0/5	0/5	1/5	3/5
Ankle plantar flexors	0/5	0/5	1/5	3/5
Trunk muscles (F/E)	2/5 and 2/5		3/5 and 3/5	
Trunk Impairment Score	8		15	
Functional Independence Measure Scale	87		118	
Fatigue Severity Score	8		3.8	
6 Minute Walk Test Predicted Distance Covered=750m				
Distance Covered	16.8m		67.2m	
Energy Expenditure	10000		2333	

3. DISCUSSION

3.1 Young individual with chronic disease are physically inactive and psychologically severely stressed about multiple factors. This increases their lifetime dependency for activities of daily living and putting patient at high risk to develop secondary complication and deformities. Recent evidence stated that in neurologic condition, patient is unable to produce movements; the rehearsing of a skill with motor imagery is believed to help keep the motor program active, thus priming and facilitating the future execution of specific movements [9]. Mental practice is expected to act on declarative knowledge at non-conscious levels of learning by improving retention level of movement's pattern and rehearsing neuronal network involved in the skill performance [10].

3.2 PNF diagonal pattern technique that works on repeated stretch and resistance helps in attaining functional range of motion and improving muscle strength of limb. It works on Sherrington principal of autogenic inhibition which states that inhibitory signals sent from the Golgi tendon organ of an overly contracted or stretched muscle lead to decrease in the excitability. Studies have shown progressive resistance training for non-paralysed muscles increases strength as well as quality of life in SCI patients and individual with partial paralysis following spinal cord injury get stronger with time [11]. It also stated that there is strong evidence to indicate that people with partial paralysis following SCI get stronger with time. This evidence comes from longitudinal studies [12] which show changes in strength and neurological status with accompanying changes in function. It is generally assumed that these increases are due to a combination of central and peripheral factors. The peripheral factors include muscle hypertrophy and the central factors include neural adaptations, either at the site of the injured spinal cord or even possibly within the brain.

3.3 Trunk function majorly has three components stability, dynamic balance and coordination. There was an improvement in trunk impairment scale score, indicating pelvis PNF pattern along with resistance would have added up more trunk stability and dynamic coordination with limb movements. Manual trunk perturbations within base of support and rhythmic pelvic and scapular stabilization would have increased more rigidity and stability to trunk muscles. Studies have shown that manual perturbation improves static balance in stroke patients [13] and stepping strategy in older individuals [14]. An exercise program that involves PNF diagonal limb movement patterns, that are parallel to muscular topography, resembles the functional activities and also helps in improving balance and activities of daily living of an individual.

3.4 Three major components of functional independence measure viz. sphincter control, transfers and mobility were chosen for mental practise with functional PNF and showed drastic improvement. Mental practice along with physical assistance to functional diagonal pattern task helps in attaining proper execution and improves accuracy of task. This might have resulted in improved Functional Independence Measure score. This suggests that combination of diagonal motion patterns on functional task and mental practise facilitates motor reorganization and motor regeneration of brain circuit that works on the neuroplasticity principle.

3.5 Individual with SCI or Syringomyelia has higher energy expenditure and easy fatigability than healthy individuals. Functional PNF with mental practise helped in reducing energy expenditure by 3 times than early stage and improved six minute walk functional capacity by 4 times with no pacing. This could be because mental practise prepares the patients to set a

proper goal mentally while training of functional PNF task like static supported cycling with stretch and resistance, might have improved cardiovascular and muscle endurance. This helped in functional task energy conservation [15] leading to decrease in fatigue level and more distance covered in 6 minute walk test. Studies have shown that increase in muscle strength, endurance and learning of energy conserving techniques helps in reducing the fatigue levels in SCI individual [15,16,17] PNF techniques including repetitive concentric, eccentric and static muscle contraction that helped in achieving functional goals and improved muscle coordination and endurance to accomplish functional set goal[8]. This could be the reason for decrease in fatigue severity score.

4. CONCLUSION

We concluded that Proprioceptive Neuromuscular Facilitation with Mental Practice does help to improve activities of daily living in Syringomyelia patient.

Consent Disclaimer:

As per international standard or university standard, patient's consent has been collected and preserved by the authors.

Conflict of Interest: None

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