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Case Report
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Effects of the PNF Technique on Increasing Functional Activities in Patients after an Incomplete Spinal Cord Injury: A Case Report

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Abstract

Introduction: Clinical features of spinal cord injury are described as part of neurological syndromes of commotion, complete and incomplete lesions. Paraplegia is a consequence of spinal injury in the thoracic, lumbar and sacral part of the spine characterized by partial (paraparesis) or complete loss of function below the level of injury. There are many secondary complications, and the most important ones are proprioceptive deficits and reduced balance that greatly reduce the participation of patients in their daily activities.

Aim: The aim of this study was to determine the ability of the PNF technique to increase the functional activity of a patient with incomplete spinal cord injury (TH11 - TH12) included in the PNF therapy for six months.

Results: The problem the subject noted when taking the initial status was walking over longer distances and walking up the stairs. Functional abilities of the subject were evaluated by Spinal Cord Independence Measure (SCIM) and Berg balance scale. Evaluation was performed prior to, in the middle of, and after the intervention. The subject was included in the PNF therapy twice a week for 45 minutes in a period of 6 months. There was an increase in the results of the Berg Balance Scale test as well as SCIM results in the area of the locomotion, specifically in the area of mobility in bed, mobility inside and outside the house at 10 meters to 100 meters distance and using the stairs.

Conclusion: The results of this study show that the PNF technique might have a positive effect on increasing the functional abilities of subjects with incomplete spinal cord injury. However, further research is required with a larger number of subjects to make a final conclusion on the effect of the PNF technique on the functional abilities of persons with spinal cord injuries.

Keywords: Spinal injuries; PNF concept; Functional activities

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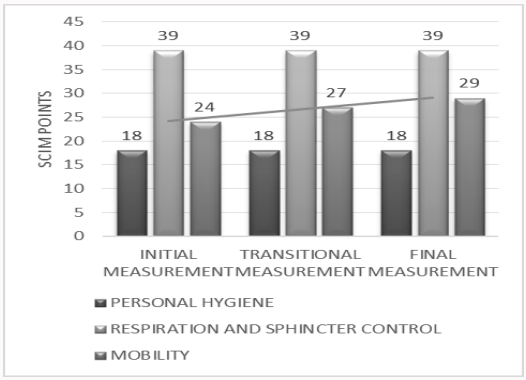
Introduction

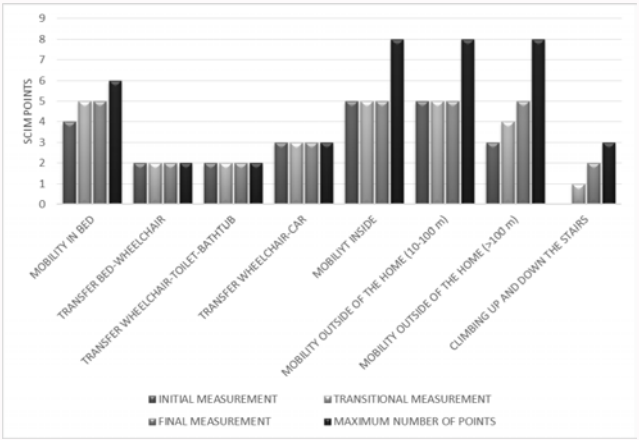
Injuries of the spine and spinal cord injuries represent a major health and socio-economic problem of society due to limited treatment options of resulting neurological deficits and disabilities [1]. They have an average incidence of 20-40 people per million inhabitants per year [2] but there are significant variations in epidemiological data at the international level [3]. Clinical picture of spinal cord injury is described within neurological syndromes of commotion, complete and incomplete lesions. Paraplegia is a consequence of spinal injury in the thoracic, lumbar and sacral part of the spine characterized by partial (paraparesis) or complete loss of function below the level of injury. Secondary complications in the spinal cord injury are many and greatly reduce the quality of life of the patient. Most commonly, they are urinary, gastrointestinal, skin, musculoskeletal, neurological, respiratory, cardiovascular, endocrine and psychological complications [4]. The loss of proprioception after spinal injuries significantly affects the locomotor function. People with incomplete spinal cord injuries rely heavily on visual information as a compensation for proprioceptive deficit and weakened balance, which contributes to greater risk of falls. Because of this, they have difficulties in participating in activities that would enable them to fully reintegrate into society.

Aim

The aim of this paper was to determine the influence of PNF (Proprioceptive Neuromuscular Facilitation) on the enhancement of the functional abilities of a person with incomplete spinal injury. Specific PNF techniques, combining diagonal patterns with normal movement facilitation,



Graph 1: Assessment of daily life activities of the subject before, during and after the PNF therapy intervention.

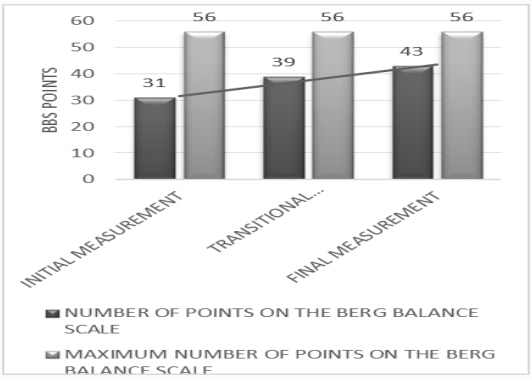


Graph 2: Assessment of mobility of the subject before, during and after the PNF therapy intervention.

are used for motor control regeneration in adults with neuromuscular and muscular - bone deficits [5]. The goal of the PNF technique is to facilitate normal movement through facilitation, inhibition, strengthening, and relaxation of muscle groups. Techniques use concentric, eccentric and static muscle contraction to achieve certain functional goals [5]. The PNF technique encompasses four levels of motor control: proper postural adjustment through motion initiation, retention of the default position versus gravitational activity, selective movement along with maintaining normal posture versus gravitational activity, and proximal stability versus distal dynamic mobility for manipulating objects in the environment.

Methods

Functional abilities of the subject were assessed with Spinal Cord Independence Measure (SCIM) [6] and Berg Balance Scale [7]. The SCIM scale estimates activities of daily living, respiratory function, stool and bladder control, transfers, mobility inside and outside the home, which gives a realistic picture of the functioning of patients with spinal cord injuries. The SCIM scale is easy to use because score responses are provided for each of the observed activities and each activity is evaluated based on that scale. The maximum number of points that can be collected on the test is 100, which indicates complete independence of the interviewee on the help of others. Berg Balance Scale is an objective measure of static and dynamic balance. It evaluates fourteen functional actions. It estimates balance in position and during change of position. It consists of a five-level



Graph 3: Assessment of balance of the subject before, during and after the PNF therapy intervention.

ordinal scale. The maximum score is 56 and the score less than 45 indicate an increased risk of falling. The evaluation was carried out in three time points: initial, transitional (after 3 months) and final (after 6 months).The subject was included in PNF therapy performed by a physiotherapist twice a week for 45 minutes in a period of 6 months. Diagonal tract patterns and lower extremity approximations were used, with the facilitation of normal movement in all postural positions. The intervention was conducted in a sports hall at the Center for Education vinkobek and at the home of the patient. The equipment used was: Pilates ball, stairs, standard size chair, sports bench and mat.

Subject

16 years ago, J.M. had suffered a thoracic spine injury at the level TH11-TH12 with an incomplete lesion. The motoric and sensory function has been preserved in more than three segments, caudally from the injury level. There is a neurological deficiency in the form of paraparesis. He is categorized as an athlete with a disability. Anamnestic data of the subject are presented in Table 1.

Assessment of walking

According to the subject, he is able to walk a four-stroke walk with two forearm crutches on flat ground and uphill. Walking downhill is possible but takes a lot of effort. Subject is not walking longer distances. He is walking only inside his home where all the architectural barriers have been removed. He does not walk up and down the stairs. By inspecting, it was determined that during walking the knee is hyper extended. There was no pelvis rotation, but there was a posterior pelvic tilt. During all the seven observed stages he was walking full surface on the podium and the respondent was constantly looking at his feet when walking. Steps are continuous, the heels are separate, the left and right steps are symmetrical, and when stepping forward the foot always crosses the supporting leg.

Initial assessment of balance and activities of daily living

For the purpose of assessing the activities of daily living, the SCIM test was used. He achieved 18/20 points in self-care activities, 39/40 in activities related to breathing and stool and urine control, and 24/40 points in the activities related to transfers and locomotion. The subject is independent in the area of self-care, respiration and sphincter control. Moderate help is needed in locomotive activities. Person achieved 31 points on the Berg Balance Scale indicating an increased risk of falls. Accordingly, short-term and long-term physiotherapeutic goals are set out in Table 2.

Table 1: Ananmnestic data of the subject.

Year of birth	1969
Sex	Male
Level of education	Secondary education
Employment status	Disabled war veteran
Marital status	Married
Sports activities	Wheelchair basketball
Diagnosis	Spinal cord injury th11-th12
Use of orthopedic aids	Forearm crutches and sports wheelchair for training
Involvement in a rehabilitation program	No
Problem reported by the patient	Walking longer distances, walking up and down the stairs

Table 2: Physiotherapeutic intervention goals.

Long-term goals	**Use of long-distance walking without fatigue**
	Increase of SCIM results in the area of locomotion
	Increasing the Berg Balance Scale results
Short-term goals	Improvement of vertical balance with reduced base of support
	Increasing the time spent vertically without holding onto things
	Lifting from the floor with the help of forearm crutches
	Mastering the stairs with the help of forearm crutches
	Learning to walk with the help of forearm crutches without visual control of the feet

Results

Walking ability

One of the main problems the subject had was impaired interaction with the environment due to constantly being focused on his feet when walking. During the intervention, gradual progress in that regard was observed. At the end of the intervention, he was less concentrated on his feet while walking.

SCIM scale results

After the PNF treatment, there was a score increase in the area of locomotion, specifically in the area of mobility in bed (from initial 4 to final 5 points), mobility outside the house at distances of more than 100 meters (from initial 3 to final 5 points) and using the stairs (from initial 0 to final 2 points). Changes in daily life activities and specifically mobility of the subject before, during and after the intervention are shown in Graphs 1 and 2, respectively.

Results of the BERG balance scale

There was an increase of the Berg Balance Scale results. Initially, the subject scored 31 points out of possible 56. In the transient measurement he scored 39, and in the final 43 points. Specifically, there have been improvements in the following activities: sitting down from a standing position, transfers, standing without support with eyes closed, standing with feet together, lifting objects from the floor from a standing position, rotation of the head while looking left and right, turning on his axis through 360°, alternately putting feet on a step in the standing position, standing on one leg, and standing without support with one leg in front of the other.

Discussion

There was an increase in SCIM scale scores in the area of locomotion, in the area of mobility in bed, mobility outside the house at distances greater than 100 meters and walking on stairs. These results suggest that a combination of diagonal motion patterns and normal movement might facilitate motor reorganization and motor regeneration. This also confirms that proprioceptive input could affect neuromuscular control, thus improving the performance of functional activities in people with spinal injuries.

There was also an improvement in the Berg Balance Scale results during and after the therapy. This progress supports the fact that increasing proprioceptive information integrated in the activities of daily life can contribute to the static and dynamic balance, thereby minimizing the possibility of falling. This also confirms that the increase in proprioceptive information can reduce the compensatory strategies during movement in persons with spinal injuries, i.e. relying on visual information as a compensation for the proprioceptive deficit.

Conclusion

Based on the obtained results we can conclude that the PNF technique might have a positive effect on the increase of functional abilities of the subject with incomplete spinal cord injury. However, further research is required with a larger number of subjects to make a final conclusion on the effect of the PNF technique on the functional abilities of persons with spinal cord injuries. Also, given that the subject is engaged in competitive sports, the generalization of the results obtained to a standard population with spinal injuries is questionable.

References

1. Garcia-Altes A, Perez K, Novoa A, Bernabeu M, Vidal J, Arrufat V, et al. Spinal cord injury and traumatic brain injury: a cost-of-illness study. Neuroepidemiology. 2012;39(2):103-8.

2. Rotim K. Neurotraumatology: Spinal traumatology. Zagreb: Medicinska naklada, 2006:47-54.

3. Hagen EM, Rekand T, Gilhus NE, Gronning M. Traumatic spinal cord injuries- incidence, mechanisms and course. Tidsskr Nor Laegeforen. 2012;132(7):831-7.

4. Middleton JW, Lim K, Taylor L, Soden R, Rutkowski S. Patterns of morbidity and rehospitalisation following spinal cord injury. Spinal cord. 2004;42(6):359-67.

5. Singh K, Arora L, Arora R. Effect of proprioceptive neuromuscular facilitation (PNF) in improving sensimotor function in patients with diabetic neuropathy affecting lower limbs. Int J Physiother. 2016;3(3): 322-36.

6. Itzkovich M, Tripolski M, Zeilig G, Ring H, Rosentul N, Ronen J, et al. Rasch analysis of the Catz-Itzkovich spinal cord independence measure. Spinal Cord. 2002;40(8):396-407.

7. Behrman A , Harkema S. Locomotor training after human spinal cord injury: A series of case studies. Phys Ther. 2000;80(7):688-700.