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To Study the Effect of PNF and Treadmill Training on Improving Balance, Mobility and Fatigue in Multiple Sclerosis Patients

Mohammed Aslam Ahmed[1], Rinku Yadav[2]

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Abstract

A total of 24 patients meeting the internal and external criteria were taken for the study. Mean values of their age was 38.20 ± years. And assigned into two groups, A & B, each group consisting 12 patients. In experimental study. Both groups received regular physiotherapy treatment throughout the study period other than Dynamic slow reversal PNF treadmill training. Group B (Experimental group) were treated with Dynamic slow reversal PNF technique in addition to regular physiotherapy program which they were undergoing on regular basis technique and whereas Group A (Control group) patients were treated with treadmill training in addition to regular physiotherapy program which they were undergoing on regular basis. Treadmill training consisted of supervised aerobic exercise delivered three sessions each week for 4 weeks. The mean MFIS scores was 25.75 for the Experimental Group (p<0.05) and 31.25 for the Control Group (p < 0.05). The mean BBS scores was 41.50 for the Experimental Group (p<0.05) and 34.25 for Control Group (p < 0.05). The results of this experimental study reveal that participants in the PNF group who participated in 4 week program showed significant improvements in basic mobility, balance and reducing fatigue post treatment.

Keywords: Dynamic slow reversal PNF technique; MFIS scores; BBS scores.

Introduction

Multiple sclerosis (MS) is a chronic disease of the central nervous system in which the body's own immune system attacks the myelin sheath surrounding the axons of neurons in the brain, brain stem and spinal cord.[1] MS is currently the most prevalent disabling neurologic disease of young adults in America.[2] The onset of MS usually occurs between 20 and 50 years of age, with a peak at 30 years. MS is more common in women than men by a ratio 2:1.[3] There are no large scale epidemiological studies from India on the incidence and prevalence of Multiple sclerosis. Based on hospital statistics a prevalence of approximately 1.33/100,000 was reported by Singhal *et al*. in the mid eighties from the west coast of India.[4] Although the exact etiology of the disease is unknown, it is generally accepted that MS involves an abnormal immune response within the central nervous system.[5] The variable distribution of demyelination and axonal loss throughout the central nervous system may lead to disorders of strength, sensation, co-ordination and balance, as well as visual, cognitive and affective deficits, that may lead to severe progressive limitations of functioning in daily life.[5] Common symptoms of MS include decreased walking ability and balance, as well as increased muscle weakness and fatigue. These symptoms and several others are not only detrimental to general health, but the ability to perform routine life activities, such as those mentioned above, and many other everyday motor movements.[2]

Author Affiliation: [1]Pricipal/Associate Professer, [2]Assistant Professer, Uttaranchal (Pg) College of Biomedical SCS and Hospital, Sewla Khurd, Near Transport Nagar Sharanpur Road, Dehradun, Uttarakhand, 248001, India.

Corresponding Author: Rinku Yadav, Assistant Professor, Uttaranchal (Pg) College of Biomedical SCS and Hospital, Sewla Khurd, Near Transport Nagar Sharanpur Road, Dehradun, Uttarakhand, 248001, India.

E-mail: aslamahmed5477@gmail.com

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Mobility impairment is also a major consequence of MS. Declines in functional mobility are associated with loss of social connection, reduced participation and altered abilities to perform self-care, productivity and leisure occupations.[6] MS patients also experience muscle weakness as a major obstacle, contributing to poor balance, risk of falls, and limiting activities of daily living. Few past reviews concluded that physical therapy provides clear muscle strengthening benefits for people with MS regardless of the type of exercise used in treatment.[1]

One of the most common MS symptoms is generalized fatigue unrelated to physical exertion: 40% of patients in one study described fatigue as their single most disabling symptom. Several studies, including the widely-cited Petajan et al study, demonstrated that regular physical activity may alleviate MS-related fatigue while enhancing functional reserve capacity.[1] The Fatigue Management Panel of the Multiple Sclerosis Council for Clinical Practice Guidelines defines fatigue as "a subjective lack of physical or mental energy that is perceived by the individual or caregiver to interfere with usual and desired activities.[7] Fatigue among MS individual defined as "a sense of physical tiredness and lack of energy, distinct from sadness and weakness".[8] Up to 92% of the patients complains of fatigue and is one of the most common and troubling problems.[9] Over 80% who have fatigue report that it is exacerbated by heat, which appears to be different between MS fatigue and fatigue due to other chronic diseases.[8] A study done by Broach and Dattilo (2001) have found increases in performance for individuals with MS while walking up and down stairs, rotations on a stationary bike and an upper extremity ergo meter. Reversal of antagonists is a general class of techniques in which the patient first contracts the agonistic muscle then contracts their antagonists without pause or relaxation. Within that class Dynamic reversal of antagonist is an isotonic technique where the patient first move in one direction and then in the opposite direction without stopping. There is a paucity of data about the application of PNF techniques in patients with multiple sclerosis and there are limited studies examining the effect of PNF exercises in multiple sclerosis. Because limited research related to the effects of PNF exercises on mobility, balance and muscular fatigue has been found, this study was designed to study the efficacy of dynamic slow reversal technique in patients with multiple sclerosis.

Methodology

Sample: A total of 24 patients meeting the internal and external criteria were taken for the study. Mean values of their age was 38.20 ± years. And assigned into two groups, A & B, each group consisting 12 patients.

Study design: Experimental study

Inclusion Criteria

- Diagnosis of clinically or laboratory supported MS
- MS patients with mild to moderate disability (Expanded Disability Status Scale scores 1.0 to 5.5)
- Ambulatory MS Patients
- Stable disease process within last 6 weeks
- No clinical relapse for at least one month prior to study entry
- Age between 25 and 55 years
- No concomitant therapy with anti depressant, psychoactive or steroid drug, as well as with other drug that are used for the treatment of fatigue (eg. amantadine)
- No surgeries in past 6 months.

Exclusion criteria

- Patients with current relapse of multiple sclerosis
- Any major surgeries in the past 6 months
- Pregnancy
- History of cardiovascular, respiratory, orthopedics or metabolic disease as diagnosed by physician
- Any disease preventing participation in the prescribed exercise program
- Any mental illness as diagnosed by physician

Protocol

Both groups received regular physiotherapy treatment throughout the study period other than Dynamic slow reversal PNF technique and treadmill training. Group B (Experimental group) were treated with Dynamic slow reversal PNF technique in addition to regular physiotherapy program which they were undergoing on regular basis whereas Group A (Control group) patients were treated with treadmill training in addition to regular physiotherapy program which they were undergoing on regular basis. Treadmill training consisted of supervised aerobic exercise delivered

three sessions each week for 4 weeks. Patients were provided rest period immediately after the treadmill training. Each treatment session per day lasted for about 45 minutes for PNF and 30 minutes for treadmill training, which included 5 minutes warm up and 5 minutes cool down period with a total of 12 treatment sessions (three times a week for 4 weeks). APMHR were calculated by following formula. Calculate predicted maximum heart rate (MHR) by subtracting age from 220.

The subject was allowed to stop the treadmill training in between if he/she felt fatigued.[1]

The measurement of both the groups was done at baseline and at 4 weeks after the study period finished.[1]

Results

Procedure

A total of 24 subjects who were previously diagnosed as casa of multiple sclerosis by a neurologist and met the inclusion criteria where included in the study prior to enrolling in to the study, met and purpose of the study were told to the participants. Informed consent were signed before study.

Group B (Experimental group)[2]

The treatment in this group consisted of dynamic slow reversal PNF technique applied to the lower extremities. The subject remained in relaxed, comfortable and supine position on the bed with the feet uncrossed. Therapist stands on either side of the lower limb of the subjects. At the start, the muscles of the dominant lower extremity were placed in the longest position.[2]

This technique involved a dynamic concentric contraction of the stronger agonist muscle group. A second dynamic concentric contraction immediately followed, this time involving the weaker antagonist muscle group.[3] The elements of PNF, such as manual contact, stretch, resistance, and verbal cuing, were incorporated into the treatment scheme. The efforts of the patient and my self were well synchronized.

The lower extremity has two diagonals (D1 and D2) named after the hip motion. Hip abduction is the leg movement from middle to the side and adduction means the contrary movement, toward the middle. At internal rotation of the hip, knee point to middle and in external rotation to the side. In each pattern of exercise the three distinct movements were combined similar to the functional human movements. The movement series was performed according to the principles of PNF in a distal to proximal direction.[4] The motion started with an initial stretch reflex and followed the movement of the subject's limb, so a continuous resistance was being given. Two minutes of rest period was given after each exercise pattern was practiced for 5 times.

D1 flexion and D1 Extension

Starting with the antagonist pattern Hip was placed into extension abduction and internal rotation, the knee into extension; planter flexion and eversion of the ankle; and toes flexion.[5]

Agonist patterns of flexion, adduction, and external rotation, and an antagonist pattern of extension, abduction, and internal rotation were used.[6]

D2 flexion and D2 Extension

Agonist patterns of flexion, abduction, and internal rotation and an antagonist pattern of extension, adduction, and external rotation were used.[7]

Description[8]

- Subject was lying on the supine position.
- Therapist stands on either side of the lower limb of the subjects.
- Myself resisted the patient's movement in one direction, usually the stronger or the better direction.
- As the end of desired range of motion approached, I reversed the grip on the distal portion of the moving segment and gave a command to prepare the change of direction.
- At the end of desired movement I gave the action command to reverse direction, without relaxation and gave resistance to knee motion starting at the distal part.
- When the patient began moving in the opposite direction, I reversed the proximal grip, so that resistance opposed the new direction.
- The reversal may be done as often as necessary.[8]

Group A (Control group)[9]

Therapist stood on the side of the treadmill.

Individuals received supervised treadmill training, three sessions each week, for 4 weeks. Walking duration was increased during the

training period as tolerated by participants, up to a maximum of 30 minutes. Depending on the individuals performance and tolerance rest were incorporated during the treadmill training session. Once maximum walking duration was attained, intensity was increased by increasing walking speed. Individuals were encouraged to train at an intensity of 55–85% of age predicted maximum heart rate (APMHR) according to American College of Sports Medicine guidelines.[9]

Initially 55-60% APMHR was set to perform which was considered moderate intensity in treadmill training. After conditioning period was over vigorous intensity was set between 60-85% to be performed by participants.[10]

Subjects on motorized treadmill were trained with unrestricted garment, light weighted shoes andsupported by handrail of the treadmill. Treadmill training was given initially with short bouts of low intensity treadmill for 5 minutes followed by 20 minutes of continuous as tolerated treadmill training of intensity 55-85% of age predicted maximum heart rate (APMHR) by heart rate monitor.[10,11]

Blood pressure, heart rate and perceived exertion (CR10-RPE) were monitored manually pre and post training session. If blood pressurerose to >200 mm Hg systolic or >110 mm Hg diastolic orHR rose to >160/min, training was discontinued. After 20 minutes period 5 minutes of cool down period with short bouts was given which included low intensity of treadmill. Patients were encouraged to train at intensity of 55–85% of age predicted heart rate (APMHR). Speed was increased according to the patient's tolerance. Fan and water were available to counter the effects of heat. The intensity of exercise was reduced if aggravating symptoms arosed during treadmill training session. Exercise was stopped immediately if unusual symptoms were experienced (e.g. dizziness, nausea, or chest pain) by the subjects.[10,11]

After 4 weeks the post intervention data was collected.

Fig. 1: Starting position of D1flexion

Fig. 2: Final position of D1 Flexion

Fig. 3: Starting Position of D1 Extension

Fig. 4: Final position of D1 Extension

Fig. 5: Starting Position of D2 flexion

Fig. 6: Final position of D2 Flexion

Fig. 8: Final Position for D2 Extension

Fig. 7: Starting Position for D2 Extension

Fig. 9: Motorized treadmill

Inter group comparison of pre and post TUG score between Group-A and Group-B

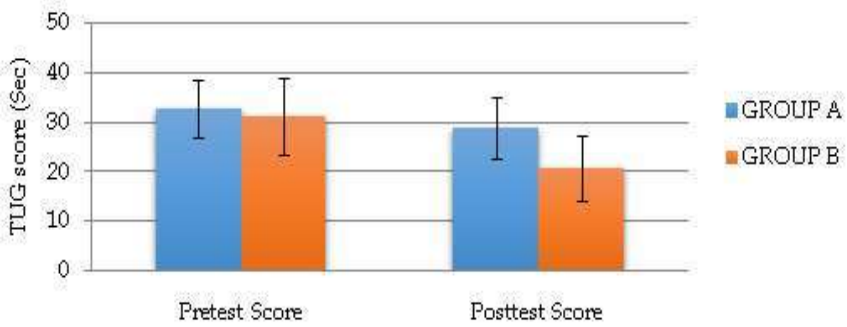

Fig. 10: Depicts improvement in mean difference of pre TUG score of subjects of Group-B as compared to subjects of Group-A

Inter group comparison of pre and post MFIS score between Group-A and Group-B

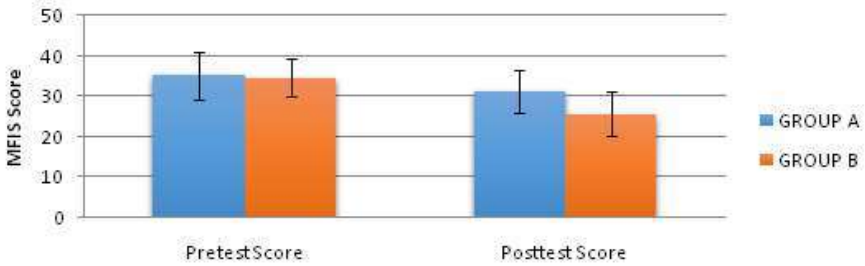

Fig. 11: Depicts improvement in mean difference of pre MFIS score of subjects of Group-B as compared to subjects of Group-A

Discussion

Physiotherapy in MS has become an essential approach in the recent years because of functional, psychological, and physical limitation of MS. Numerous studies have investigated disability and quality of life in MS. In the PNF approach, there is a large emphasis on effective motor learning strategies such as practice, repetition, visual guidance of movement, and so forth.[17] In this Experimental study Experimental group showed improvements in the post test parameter of TUG, MFIS, BBS, as compared to the pre testparameters,as shown in table 2 and figure 4 the mean post-TUG scores was 20.58 (p<0.05) and mean pre-TUG score 31.16 (p<0.05). In Table 4 and figure 5 the mean post- MFIS scores was 25.75 (p<0.05) and pre-MFIS score 34.66 (p<0.05). In Table 6 and figure 6 the mean post- BBS scores was 41.50 (p<0.05) and pre-BBS sore 30.58 (p<0.05). In this experimental study both the Control group and Experimental group showed improvements in the post test parameter of TUG, MFIS, BBS, as compared to the pre test parameters. As shown in table 2, figure 1 and figure 4 the mean TUG scores was 20.58 for Experimental Group (p<0.05) and 28.75 for Control Group (p<0.05). In Table 6, figure 3 and figure 6 the mean BBS scores was 41.50 for the Experimental Group (p<0.05) and 34.25 for Control Group (p<0.05).

The results of this experimental study reveal that participants in the PNF group who participated in 4 week program showed significant improvements in basic mobility, balance and reducing fatigue post treatment.

Limitations

1. This study was done on a small sample size.
2. This study was not checked on long term basis.
3. No follow up was done.

Conclusion

PNF exercises can be applied to patients of all ages. From this study it is clear that the dynamic slow reversal PNF technique was superior to control group in improving the balance, mobility and fatigue in patients with multiple sclerosis, hence such patients can be give dynamic slow reversal PNF technique for improving their balance, mobility and reducing fatigue.

Clinical Significance

Proprioceptive neuromuscular facilitation techniques incorporate movement in the three planes of the body. According to the International PNF Association, the PNF approach is considered to be a conceptual approach. Some authors regard it as a method. The differences in considering the terms, concept and method become clear by the description of using components of the PNF approach and the clinical reasoning in making up a treatment strategy. Whether promoting flexibility, developing functional movement, developing muscular strength and endurance, improving joint stability, or increasing neuromuscular coordination and control, PNF technique ie. dynamic slow reversal, as proven in this study ,should be incorporated into the physical therapy setting as a valuable and efficacious component of rehabilitation for patients with multiple sclerosis.[19]

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From Uttranchal PG College of Bio-medical scs and hospital.

Ethical Clerence

It is bonafied work done by meand I have not taken any part of thesis from any where.

References

1. Eszter Németh *et al.* PNF Induced Irradiation on the Contralateral Lower Extremity with EMG Measuring.
2. Zuhal Gültekin *et al.* Hemodynamic and Lactic Acid Responses to Proprioceptive neuromuscular Facilitation Exercise: Journal of Sports Science and Medicine. 2006;5:375–80.
3. Carolyn Kisner, Lynn Allen Colbykisner. Therapeutic Exercise: *Foundations and Techniques,* 5th edition.
4. James R. Scifers: The Truth about PNF Techniques: Vol. 15, Issue 26, Page 40.
5. M van den Berg *et al.* Treadmill training for individuals with multiple sclerosis: a pilot randomized trial: J Neurol Neurosurg Psychiatry. 2006;77:531–33.
6. Walter R. Thompson *et al.* ACSM's Guidelines for exercise testing and prescription: Eighth edition, 2009.
7. Buck M, Beckers D, Adler S: PNF in Practice. 2nd Edition Springer Verlag Publishers. 2000.

8. Kuniyoshi Shimura *et al.* Effects of proprioceptive neuromuscular facilitation on the initiation of voluntary movement and motor evoked potentials in upper limb muscles: Human Movement Science. 2002;21:101–13.
9. Annapurna *et al.* Multiple sclerosis: the disease and its treatment: Indian journal of pharmacology. 2002;34:3–15.
10. Marcia Finlayson *et al.* Experiencing the loss of mobility: Perspectives of older adults with MS: Disability and Rehabilitation. 2003;25(20):1168–80.
11. William S. *et al.* Multiple sclerosis-Related fatigue. Phys Med Rehabil Clin N Am. 2005;16:483-502.
12. Brown TR, Kraft GH. Exercise and rehabilitation for individuals with multiple sclerosis. Phys Med Rehabil ClinN Am. 2005;16:513–55.
13. Gail L. *et al.* Balance-Based Torso-Weighting May Enhance Balance in person with Multiple Sclerosis: Preliminary Evidence. Arch Phys Med Rehabil. 2009 Apr;90(4):602-9.
14. C Pozzilli *et al.* home based management in multiple sclerosis: result of a randomised controlled trail: J NeurolNeurosurg Psychiatry. 2002;73:250–255.
15. C Pozzilli *et al.* home based management in multiple sclerosis: result of a randomised controlled trail: J NeurolNeurosurg Psychiatry. 2002;73:250–255.