Influence of Neuromotor Facilitatory Training on Agility and Speed in Young Adults

S E. Samuel, Research Scholar,

Grace Helina, Professor and Head, Dept. of Exercise Physiology and Nutrition, TNPESU, Chennai, and

A P Krishna, Professor, KS Hegde Medical Academy, Mangalore, Karnataka

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Abstract

The purpose of this study was to estimate the effects of neuromotor facilitatory training on selected athletic performance variables - agility and speed. Young adults 18 to 25 years of age were randomly allocated into intervention and control groups with 30 subjects in each group. Neuromotor facilitatory training intervention consisted of equillibrium control exercises,closed kinematic chain exercises, PNF patterns and rhythmic stabilization exercise for 8 weeks. Speed was measured with the 50m run test. Agility was determined by the T-test. Pre and post intervention data were analysed to estimate differences with Student's unpaired 't'test. 60 collegiate students (mean age 21.61±1.22) completed the study. Agility (in secs.) showed statistically significant improvement from mean12.61±1.09 to mean11.10± 0.87 in intervention group, when compared to that in control from12.76±1.12 to 12.72±0.85. Speed (in secs.) showed statistically significant improvement from mean 9.45±0.82 to 8.60±0.75 in intervention group when compared to that in control from 9.39±1.24 to 9.54± 0.99. Neuromotor facilitatory training improves agility and speed in young adults.

Keywords: Neuromotor facilitatory training, athletic performance, speed, agility, Proprioceptive neuromuscular facilitation

Introduction

The relationship between muscle imbalance and extremity injury has been documented.7 Measures to prevent the same have been largely centered around proprioceptive and balance control training.

Physical Therapy intervention following injuries to lower extremity primarily addresses deficiencies in strength and balance subsequent to trauma. Several studies appraise the significance of proprioception training following injury. It has been reported that proprioception can still be affected one year after injury following a rehabilitation program.

Objective data on dynamic movement evaluation requires expensive equipment and hence have not found its deserved status in neuromotor evaluation for sports population. Neurological assessment has restricted mostly to conductivity, neuromuscular physical assessment, agility, strength, power and flexibility. Evidence for the effects of short and long term applications to unstable environments is inconclusive and warrants more substantial research.

A mounting body of evidence indicates that proprioceptive training can improve athletes' strength, coordination, muscular balance, and muscle-reaction times, and studies have linked proprioceptive work with a reduced risk of injury during sporting activity. It is likely to find that improved proprioception can also boost athletic performance.

Neuromotor facilitation techniques emphasizing PNF and closed kinetic chain exercises form the mainstay in balance rehabilitation, reversing the joint instability resulting from the injury by regaining joint position sense and kinaesthetic acuity- the two most commonly attributed factors to be affected following injury.

Proprioceptive training plays significant role in physical rehabilitation following sports injuries. Less research has attempted to document the effects of balance on performance measures.

It remains to be established whether the improved awareness attributed to proprioceptive training translates to enhanced functional capacity or balance ability in uninjured individuals.

Neuromotor facilitatory training refers to exercise interventions designed to facilitate the neural contributors of motor performance. Though training methods involve proprioception components, the influence of proprioceptive training on athletic performance has remained largely inconclusive.

A need was identified to evaluate the effects of neuromotor facilitatory training with proprioceptive and stabilization exercises on selected athletic performance variables.

Purpose of Study

The purpose of this study was to estimate the effects of neuromotor facilitatory training on selected athletic performance variables- agility and speed.

Hypothesis

Neuromotor facilitatory training with proprioceptive and stabilization exercises would improve speed and agility.

Review of Literature

Neuromotor exercise training is beneficial as part of a comprehensive exercise program for older persons, especially to improve balance, agility, muscle strength, and reduce the risk of falls.

A study on gymnasts attributed their ability to stand still under varied controlled proprioceptive input, to their high levels of balance and proprioceptive training.

Similar ability of Tai-Chi and golf practitioners have been reported in terms of limits of stability test and passive joint repositioning ability.

Agility, the ability to change direction of the body and its parts quickly, is a combination of many different athletic traits such as reaction time, speed, co-ordination, power and strength.

A 6-week neuromuscular training program designed to decrease the incidence of ACL injuries reported improvement in objective measures of total and anterior-posterior single-limb postural stability in high school female athletes.

Osternig et. al., investigated the effect of three common PNF stretching techniques on hamstring muscle activation and knee extension.10 They suggested that contract-relax (CR) and agonist contract-relax (ACR) do not evoke sufficient relaxation in muscles opposing knee extension to overcome tension facilitation generated by stretch,and increases in ROM are achieved while the hamstrings are under considerable tension.

Shimura et. al.attempted to better understand the mechanisms behind proprioceptive neuromuscular facilitation (PNF), an important method in motor rehabilitation, and investigated the effects of assuming a PNF posture relative to a neutral posture on the initiation of voluntary movement and the excitability of the motor cortex using a wrist extension task.16 They found that the facilitation position changed the muscle discharge order enhancing the movement efficiency of the joint.

Caplan et. al., studied the effect of proprioceptive neuromuscular facilitation (PNF)and static stretch(SS) training on running mechanics and concluded that both SS and PNF training improved Hip Flexion Range of Motion and running mechanics during high-velocity running.4Their findings suggest that stretch training undertaken at the end of regular training is effective in changing running mechanics.

Methodology

After obtaining approval for the study and ethical clearance, subjects fulfilling the requisites of the study were selected from educational institutions within city limits; students between the ages of 18 and 25 years were included using computer generation of random numbers. Subjects not participating in any other lower extremity exercise programme six months prior to / during the interventional period gave informed consent to participate in the study.

Based on the information gathered, the subjects who had history of lower limb musculoskeletal pathology (eg. fracture, muscular strain, ligament sprain, rheumatologic disease), surgery, systemic diseases, like cardiovascular conditions (eg. IHD, valvular disease, peripheral vascular disease); Respiratory problems (eg. infections / bronchial asthma); Neurological disease (eg. epilepsy, neuropathy, dementia) were excluded from participating in this study.

Subjects were divided into two groups, namely, experimental group (Group A) and control group (Group B).

Prior to experimental treatment, all the subjects were measured of selected variables. Speed was measured with the 50m run test. Agility was determined by the T-test.

The 8 weeks neuromotor facilitatory training consisted of equilibrium control exercises - single limb stance on firm and foam surfaces, ankle disk training with knee extension and arm extension, closed kinematic chain lower body exercises, Proprioceptive Neuromuscular Facilitation (PNF) patterns and rhythmic stabilization exercise.

Control group received no exercise intervention. Additionally, the subjects of the control group were asked not to involve in any special training or physical activities during the experimental period.

After a period of eight weeks both the groups were measured on the criterion variables, which formed the final scores. Baseline data was compared with data after 8 week study period. Data analysis was done using Student's "t" test. The difference between the initial and final means was considered as the effects of neuromotor facilitatory training on determinants of athletic performance.

Results

Data from 60 collegiate students (mean age 21.61±1.22) who completed the study was analysed.

Agility (in secs.) showed statistically significant improvement from mean12.61±1.09 to mean11.10± 0.87 in intervention group, when compared to that in control from 12.76±1.12 to 12.72±0.85. The improvement between the groups was statistically significant ($p<0.05$).

Table - I

Pre and Post-test Agility for Experimental group

Group A	Mean	MD	SD	SDM	t'
Pre	12.61		1.09		
Post	11.10	1.52	0.87	0.26	5.94*

Required table value df (1,29) 2.045
* Significant at 0.05 level

Table - II

Pre and Post-test Agility for Control group

Group B	Mean	MD	SD	SDM	t'
Pre	12.76		1.12		
Post	12.72	0.03	0.85	0.26	0.13

Required table value df (1,29) 2.045
Not Significant at 0.05 level

Table - III

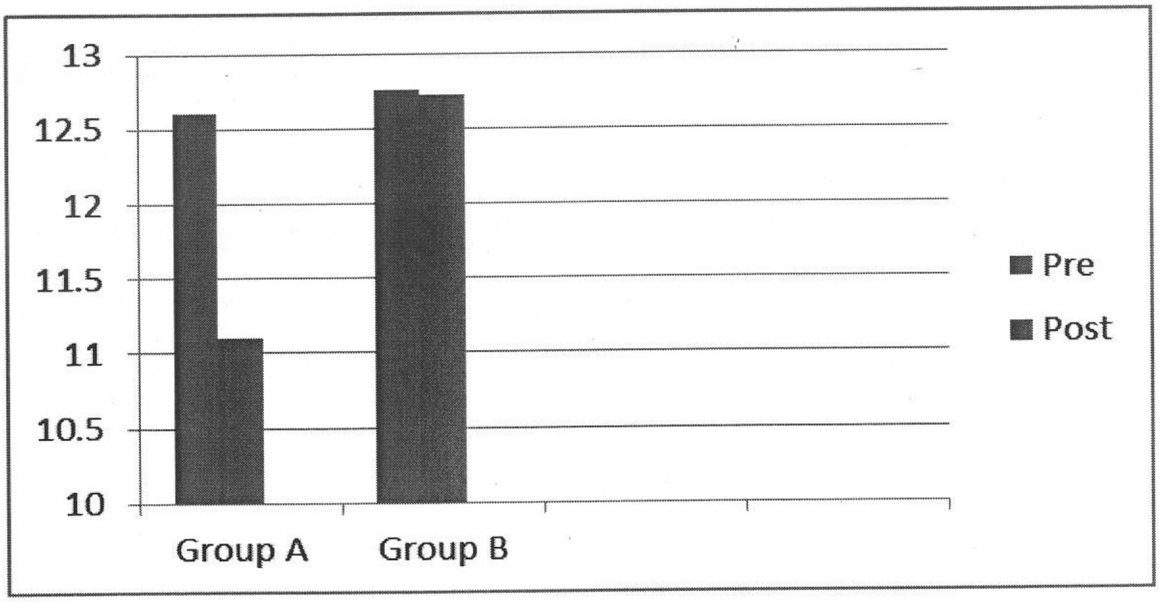
Comparison of post-test Agility among groups

Group	Mean	MD	SD	SDM	t'
A	11.10		0.87		
B	12.72	1.63	0.85	0.22	7.34

Required table value df (1,29) 2.045
* Significant at 0.05 level

Figure -1

Comparison of pre and post-test Agility among groups



Speed (in secs.) showed statistically significant improvement from mean 9.45±0.82 to 8.60±0.75 in intervention group when compared to that in control from 9.39±1.24 to 9.54± 0.99. The improvement between the groups was statistically significant ($p<0.05$).

Table - IV
Pre and Post-test 50m run for Experimental group

Group A	Mean	MD	SD	SDM	t'
Pre	9.45	0.85	0.82	0.20	4.21*
Post	8.60		0.75		

Required table value df (1,29) 2.045
* Significant at 0.05 level

Table - V
Pre and Post-test 50m run (secs.) for Control group

Group B	Mean	MD	SD	SDM	t'
Pre	9.39		1.24		
Post	9.54	0.16	0.99	0.29	0.55

Required table value df (1,29) 2.045
Not Significant at 0.05 level

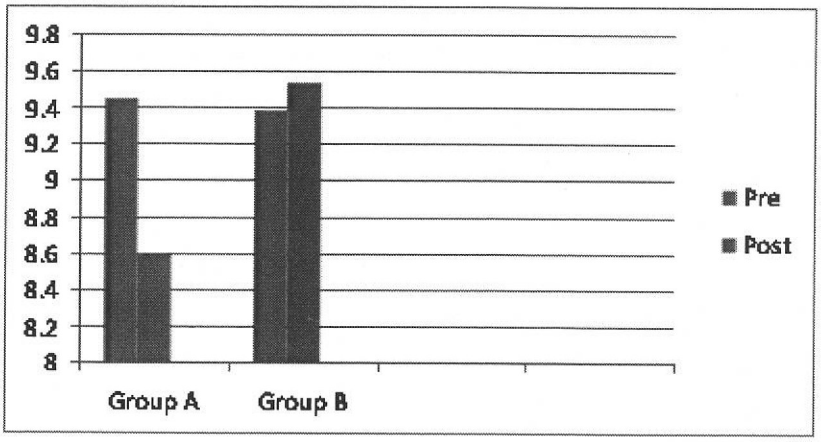
Table - VI
Comparison of post -test 50m run (secs.) among groups

Group	Mean	MD	SD	SDM	t'
A	8.60		0.75		
B	9.54	0.95	0.99	0.23	4.18*

Required table value df (1,29) 2.045
* Significant at 0.05 level

Figure-2

Comparison of Pre and Post-Test 50m run among Groups



Discussion

Koceja DM, (2004) reported that in response to chronic physical training, the human neuromuscular system undergoes significant and specific adaptations. 8 They suggested that the influences are the result of the type and quantity of physical activity. One of the simplest neuromuscular mechanisms is the spinal stretch reflex. The reflex system was previously viewed as inflexible, with a relatively fixed response that could vary only slightly. However, more recent data have identified an adaptive plasticity in the reflex system.

Pereira MP reported that Proprioceptive Neuromuscular Facilitation (PNF) is an attractive method to increase strength and proprioception of elderly individuals.

Romero-Franco N, et.al. (2012) determined the effect of a 6-week specific-sprinter proprioceptive training program on core stability and gravity centre control in sprinters and concluded that the training program provided postural stability with eyes open and improvements in gravity centre control measures.

Agility training is thought to be a re- enforcement of motor programming through neuromuscular conditioning and neural adaptation of muscle spindles, golgi-tendon organs, and joint proprioceptors 2, 5, 13. By enhancing balance and control of body positions during movement, agility theoretically should improve.

Speed or the ability of the athlete to move more quickly is brought about by the mechanoceptor feedback mechanism. Therefore activities that emphasize regaining proprioceptive co-ordination and muscle recruitment should facilitate rate of acceleration and maximal running speed.

This study was limited in the following aspects. Socio-economic and cultural status of the subjects were not taken into consideration. Factors like height and weight, previous training of the subjects of any kind prior to six months of experimental treatment nutrients, heredity, environment, life style habits and the students programme outside the college were not taken into consideration. Daily routine of the subjects were not controlled. Also, the subjects emotional state, medication underwent prior to six months of experimental period, caffeine intake were not considered for this study. The climatic conditions at the time of testing the subject may have influenced the results.

Conclusion

Neuromotor facilitatory training improves agility and speed in young adults.

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