EFFECTIVENESS OF NEUROMUSCULAR TRAINING IN YOUNG ATHLETES AT RISK OF LOWER EXTREMITY MUSCULOSKELETAL INJURIES

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ABSTRACT

Background: The participation of children and adolescents in the practice of physical activities and sports has increased in the recent decades. The practice of sports provides benefits to cardiopulmonary, musculoskeletal and endocrine systems. Sports leads to improvements in motor skills and daily habits as well as the acquisition of dexterity, exerting an influence on the social and psychological aspects of practitioners. Unfortunately, increased intensity and volume of sport practice lead to a higher rate of acute and overuse injuries. For the young athlete, the consequences of sports injuries could be numerous, ranging from re-injury to career-ending. Hence this study was carried to find out the effect of neuromuscular training program in athletes.

Objective: To find effects of Neuromuscular training program on young adolescent athletes.

Materials and Methods: 30 athletes were assessed with Star Excursion Balance Test (SEBT) and put through Neuromuscular training program for 4 weeks. Pre-post data was collected and analyzed with paired T test. The analysis suggested extremely significant effect of neuromuscular training program with p value <0.0001 in participants.

Result: There was a significant difference between pre-test and post-test values of the athletes.

Conclusion: The Neuromuscular Training Program is effective in improving dynamic balance in young adolescent athletes.

Keywords:

Neuromuscular training program,
Star Excursion Balance Test.

I. INTRODUCTION

The participation of children and adolescents in the practice of physical activities and sports has increased in the recent decades. The practice of sports provides benefits to cardiopulmonary, musculoskeletal and endocrine systems. Sports leads to improvements in motor skills and daily habits as well as the acquisition of dexterity, exerting an influence on the social and psychological aspects of practitioners[1]. In children and adolescents, regular sports practice facilitates the development of fundamental movement skills helps to prevent obesity and its long-term consequences and has long-lasting benefits on bone health. Unfortunately, increased intensity and volume of sport practice lead to a higher rate of acute and overuse injuries. For the young athlete, the consequences of sports injuries could be numerous, ranging from re-injury to career-ending[2].

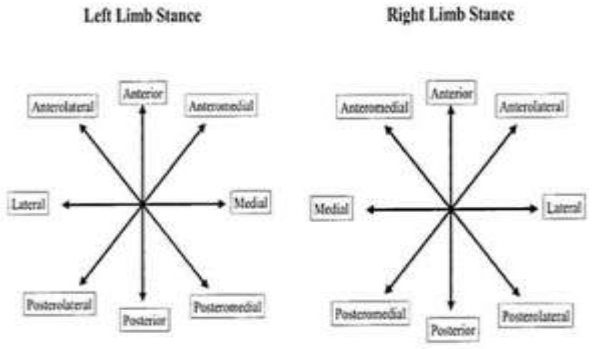
Although sports injuries are not severe enough, they are frequent and have a major economic impact through direct medical costs, treatment, rehabilitation, and indirect costs, including parents taking time of for injured offspring. Numerous injury prevention programs have been developed to modify such neuromuscular and biomechanical characteristics in an attempt to reduce the number injuries in athletes. Typically, these programs incorporate a combination of balance, plyometric, agility, resistance, and flexibility components. Considering the wide variety of movements associated with athletics, athletes must possess sufficient strength in hip and trunk muscles that provide stability in all three planes of motion[2]me off to care for the injured offspring[2].Several studies support the use of interventions such as neuromuscular training programs (NMTP) to reduce the incidence of lower extremity injuries. The most effective programs emphasize several common components, including plyometric training in combination with biomechanical feedback and technique training. Implementation of a NMTP that focuses on core stability exercises is advocated to prevent lower extremity injury. Targeted NMTP are designed to reduce injury risk, and include interventions that focus on increased control of the center of mass. As the center of mass moves away from the base of support, there is an increased potential for biomechanical deviations to occur in the lower extremity. An improved ability to control this movement has the potential to decrease excessive forces on the lower extremity and ultimately decrease injury risk[1].

The star excursion balance test (SEBT) is a functional screening tool developed to assess lower extremity dynamic stability, monitor rehabilitation progress, assess deficits following injury, and identify athletes at high risk for lower extremity injury. The SEBT requires neuromuscular characteristics such as lower extremity coordination, balance, flexibility, and strength[1].

Initiatives enhancing the awareness of trainers, athletes and therapists about risk factors and systematic prevention measures should be encouraged[2].

II. METHODOLOGY

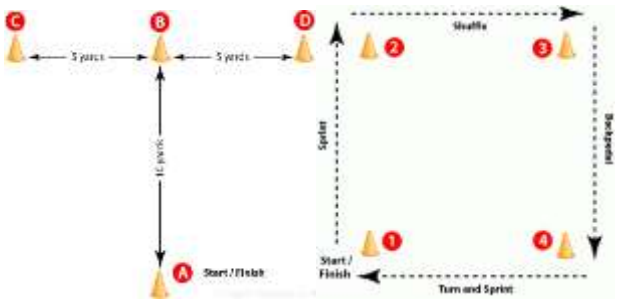
The data was collected from Fatima High School, Ambernath. It was Pre-test Post-test study design. A total number of 30 athletes participated from the said school. The study duration was four months. Sample was done by by simple random sampling method. The inclusion criteria for participants were as follows- Age group of 6-16 years, Uninjured athletes (males and females), Participants who were willing to participate. Non-athletes, physically challenged children, children with cardio-respiratory and neurological deficits and athletes with a recent history of injury were excluded from the study. Outcome measure used was the Star Excursion Balance Test (SEBT). In Star Excursion Balance Test (SEBT) , the subjects stand on one lower extremity, with the most distal aspect of their great toe on the center of the grid. The lines are arranged in a grid that extends from a centre point and are 45 degrees from one another. Each reaching direction offers different challenges and requires combinations of sagittal, frontal, and transverse movements. The subjects are then asked to reach in anterior, anterolateral, anteromedial, lateral, medial, poster lateral, posterior and posteromedial, as much as they can while maintaining their single-limb stance.



A measurement of 20cms from the center was marked as point 1, 40cms from the center was marked point 2 and so on till 120cms marked as point 6 on each direction. Subjects received a verbal and visual demonstration by the examiner. Each subject completed a pre-assessment on Star excursion Balance test. While standing on a single limb, the participant was asked to reach as far as possible with the reaching limb along each line; lightly touching the line with the most distal portion of the reaching foot without shifting weight to or coming to rest on this foot of the reaching limb; and then return the reaching limb to the beginning position in the centre of the grid, reassuming a bilateral stance. If the individual touched heavily or came to rest at the touchdown point, had to make contact with the ground with the reaching foot to maintain balance, or lifted or shifted any part of the foot of the stance limb during the trial, the trial was not considered complete. Three readings were recorded and a mean of the same was taken[5]. Neuromuscular training program of 6 days a week for 4 weeks was included in the regular training program of these athletes.

The intervention included:

1) Lower extremity and core muscle strength training (planks in different variation, squats and lunges)
2) Plyometrics (Jump Training – squat jumps, side to side jumps, single leg jumps)
3) Balance training (Single leg stance, wobble board exercises)
4) Agility drills.



Thereafter re-assessment of the 30 athletes who underwent the NMTP for 4 weeks was done again on Star Excursion Balance Test. Three readings were again recorded and a mean was taken for the same.

III. DATA ANALYSIS

Following table no.1 shows comparison of pre-test and post-test of Right Lower Extremity on Star Excursion Balance test

Reading	Anterior	Rt. Ant	Lt. Ant	Lateral	Posterior	Rt. Post	Lt. Post	Medial
Pre-test mean	3.36	3.36	3.66	3.26	3.36	3.36	3.36	2.5
Post- test mean	4.5	4.5	4.5	4.5	4.56	4.5	4.56	3.7

Following tables show comparison of pre-test and post-test Right Extremity in various directions on Star Excursion Balance test.

Anterior:

Group	Mean + SD	T value	P value
Pre-test	3.36 + 0.6149	9.109	<0.0001 considered extremely significant
Post-test	4.5 + 0.5724		

Anterolateral:

Group	Mean + SD	T value	P value
Pre-test	3.36 + 0.6149	9.109	<0.0001 considered extremely significant
Post-test	4.5 + 0.5724		

Anteromedial:

Group	Mean + SD	T value	P value
Pre-test	3.36 + 0.6149	9.109	<0.0001 considered extremely significant
Post-test	4.5 + 0.5724		

Lateral:

Group	Mean + SD	T value	P value
Pre-test	3.36 + 0.6397	9.109	<0.0001 considered extremely significant
Post-test	4.5 + 0.5724		

Posterior:

Group	Mean + SD	T value	P value
Pre-test	3.36 + 0.6149	10.770	<0.0001 considered extremely significant
Post-test	4.5 + 0.5683		

Posteromedial:

Group	Mean + SD	T value	P value
Pre-test	3.36 + 0.6149	9.109	<0.0001 considered extremely significant
Post-test	4.5 + 0.5724		

Posterolateral:

Group	Mean + SD	T value	P value
Pre-test	3.36 + 0.6149	10.770	<0.0001 considered extremely significant
Post-test	4.5 + 0.5683		

Medial:

Group	Mean + SD	T value	P value
Pre-test	2.5 + 0.5085	10.370	<0.0001 considered extremely significant
Post-test	3.7+0.4661		

Following table no.2 shows comparison of pre-test and post-test of Left Lower Extremity on Star Excursion Balance test

Reading	Anterior	Rt. Ant	Lt. Ant	Lateral	Posterior	Rt. Post	Lt. Post	Medial
Pre-test	3.36	3.36	3.36	2.53	3.33	3.36	3.36	3.36
Post- test	4.5	4.46	4.56	3.46	4.46	4.46	4.46	4.5

Following tables show comparison of pre-test and post-test of Left Leg on in various directions on Star Excursion Balance Test.

Anterior:

Group	Mean + SD	T value	P value
Pre-test	3.36+0.6149	9.109	<0.0001 considered extremely significant
Post-test	4.5+0.6297		

Anteromedial:

Group	Mean + SD	T value	P value
Pre-test	3.36+0.6149	9.104	<0.0001 considered extremely significant
Post-test	4.5+0.6288		

Anterolateral:

Group	Mean + SD	T value	P value
Pre-test	3.36+0.6149	9.109	<0.0001 considered extremely significant
Post-test	4.5+0.6297		

Lateral:

Group	Mean + SD	T value	P value
Pre-test	3.36+0.6149	9.109	<0.0001 considered extremely significant
Post-test	4.5+0.6297		

Posterior:

Group	Mean + SD	T value	P value
Pre-test	3.36+0.6149	9.104	<0.0001 considered extremely significant
Post-test	4.46+0.6288		

Posterolateral:

Group	Mean + SD	T value	P value
Pre-test	3.36+0.6149	9.104	<0.0001 considered extremely significant
Post-test	4.46+0.6288		

Posteromedial:

Group	Mean + SD	T value	P value
Pre-test	3.36+0.6149	9.104	<0.0001 considered extremely significant
Post-test	4.46+0.6288		

Medial:

Group	Mean + SD	T value	P value
Pre-test	2.53+0.5074	6.911	<0.0001 considered extremely significant
Post-test	3.46+0.5713		

IV. RESULTS

The comparison between pre-test and post-test in both right and left extremity for each direction on Star Excursion Balance Test had a p value of <0.0001, which is considered an extremely significant change.

V. DISCUSSION

The present study 'Effectiveness Neuromuscular Training in Young athletes at risk of lower extremity musculoskeletal injuries' was conducted at Fatima High School Ambernath. 30 participants from the age group 6-16 were selected based on the selection criteria. They were all assessed on Star Excursion Balance Test (SEBT) and a neuromuscular training program was included in their daily practice for 6 days a week for duration of 4 weeks. After the 4 weeks the participants were re-assessed on SEBT. The purpose of this study was to determine if a 4-week NMTP that focused on core stability and lower extremity strength could improve performance on the SEBT. The result of study was found to be extremely significant.

Poor core stability and decreased muscular synergy of the trunk and hip stabilizers have been theorized to decrease performance in power activities and to increase the incidence of injury secondary to lack of control of the center of mass. Targeted NMTP designed to reduce injury risk, include interventions that focus on increased control of the center of mass. As the center of mass moves away from the base of support, there is an increased potential for biomechanical deviations to occur in the lower extremity. An improved ability to control this movement has the potential to decrease excessive forces on the lower extremity and ultimately decrease injury risk[1].

It is proposed that resistance training may not be appropriate because it enhances muscle stretch reflexes, which may reduce co-contraction, and produces no reductions in voluntary activation times and time to peak torque. However, stability and balance training is thought to suppress muscle stretch reflexes and, in turn, enhance co-contraction. Also, stability and balance training that stimulates the knee joint ligament and capsular receptors may reinforce co-contraction patterns to facilitate greater improvements in joint stabilization. Stability and balance training and plyometric training produce reductions in voluntary activation times and times to peak torque, which may decrease muscle response times so players are more able to perform rapid and unexpected sports maneuvers. Training programs that emphasize these neuromuscular mechanisms may enhance protection of the anterior cruciate ligament and reduce the incidence of injury[8].

A study conducted by *Darin T. Leetun et al* on 'Core Stability Measures as Risk Factors for Lower Extremity Injury in Athletes' found that Core stability has an important role in injury prevention[1]. They also stated that Current literature supports the use of NMTP that incorporate core stability as part of treatment programs to prevent injury of the ankle or knee. Decreased neuromuscular control of the trunk appears to influence dynamic stability of the lower extremity during high-speed athletic maneuvers[1].

VI. CONCLUSION

From this study is was concluded that an effective neuromuscular training program focusing on Lower extremity and core muscle training has a significant improvement in SEBT, thus resulting as an effective strategy that can be included in an athletes training program.

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