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Modifying Mechanical Movement of the Attack Hit Using Neuromuscular Exercises to Prevent Injury to Players of Volleyball

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Abstract: Volleyball has become one of the most widely played participant sports in the world. Participation requires expertise in many physical skills and performance is often dependent on an individual's ability to jump and land. The incidence of injury in volleyball is similar to the rates reported for sports that are considered more physical contact sports. Objectives of the study were modifying the mechanical movement of the attack hit to avoid injury to the joints, improving the neuromuscular system using exercise and strengthening the muscles and ligaments of the joints using exercises. Research hypotheses: are there statistical significant differences in the mechanical movement of the landslide hit before and after the program. The researcher conducted the study on 8 volleyball players, patients with a history of the pathological knee joint and ankle. The researcher used the experimental method and designed an exercise neuromuscular program for 6weeks to improve performance motor. Attack hit was filmed with Panasonic camera to determine the speed of approach and flight time and the vertical jump and the angle of the knee before the jump and after landing. The researcher also measured the strength of the muscles of the legs and back and measured the balance of neuromuscular. The researcher suggested that the use of neuromuscular exercise modyfied mechanical movement of the attack hit to prevent injury. The researcher Recommend the use of neuromuscular exercise programs in the preparation of the players in various sports to prevent injuries.

Key words: Neuromuscular exercise %Prevention of injury % Volleyball % Attack hit

INTRODUCTION

Current public health recommendations strongly suggest regular physical activity to improve cardiovascular health and reduce the risk of chronic diseases [1, 2]. The risk of musculoskeletal injury also increases, however, with an increase in physical activity. The rapidly increasing number of activity-induced injuries among adolescents and young adults is currently considered a true public health burden [3,4]. Because of their anatomic location, the ankle and knee joints are subjected to tremendous force during exercise and physical activity. Thus, it is not surprising that they are the most common sites for injuries, usually accounting for 50% to 60% of all sports injuries [5, 6]. Acute injuries of the limbs, especially those affecting the ankle, knee and shoulder joints may also have long-term consequences. Ankle injuries recur easily [7-9] and severe knee injuries often lead to early osteoarthritis [10,11]. Several studies have demonstrated that a neuromuscular training program me can reduce the risk of ankle and knee injuries in athletes [12]. To our knowledge, the possibility of preventing injuries in a general population such as in young individuals with various physical fitness levels has not been assessed.

The functional training on an unstable platform (UP) has been an important method for joint rehabilitation and neuromuscular conditioning; consequently, providing an improvement of coordination and pattern of neuromuscular recruitment [13-15]. The UP training provides the largest activation of the proprioceptive system in a mainly static activity through the afferents fibers [16]. In addition, researches have also demonstrated this potential effect in dynamic activities [17,18]. Thus, regular training prevents possible joint injury and is efficient in the improvement of muscle strength,

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reaction time and balance [19,20]. Furthermore, strength gains from this type of training can be attributed to increases in muscle cross-sectional area [19].

The human core is described as the human low back-pelvic-hip complex with its governing musculature [21-23]. The core is important because it is the anatomical location in the body where the center of gravity is located, thus where movement stems [24-27]. The core functions to maintain postural alignment and dynamic postural equilibrium during functional activities, which helps to avoid serial distortion patterns [28]. Core stability is the motor control and muscular capacity of the lump pelvic-hip complex [29]. Normal function of the stabilizing system is to provide sufficient stability to the spine to match the instantaneously varying stability demands due to changes in spinal posture and static and dynamic loads, within the three subsystems proposed by Panjabi6 (active, passive and neural). Panjabi proposes that spinal stabilization is dependent on interplay between passive, active and neural control systems [30]. The passive musculoskeletal subsystem is composed of the vertebrae, facet articulations, intervertebral discs, spinal ligaments, joint capsules and the passive mechanical properties of muscles. The active musculoskeletal subsystem consists of the muscles and tendons surrounding the spinal column. The neural and feedback subsystem encompasses the various force and motion transducers, which are located in the ligaments, tendons, muscles and neural control centers. It is commonly observed that a specific training program or an environmental constraint can induce peculiar aeromechanical adaptations that are commonly considered as signs of acquisition and/or improvement of a specific movement skill [31,32]. In fact Baratta *et al.* [33] were the first ones to report significant decrease of co-activation due to skill acquisition/exercise training in volleyball and basketball athletes. They also demonstrated the plasticity of the activation neural drive by reversing it by skill/exercise regimen the activation neural drive by reversing it by skill/exercise regimen of the antagonist over several weeks. Training-related neuromuscular adaptations entail changes in movement execution that can be assessed investigating both neuromuscular control and movement biomechanics. Among the different neural and muscular factors that underlie the mentioned changes, muscle activation receives increasing attention in the scientific community.

MATERIALS AND METHODS

The use of neuromuscular exercise may reduce the risk factors that contribute to the occurrence of injuries in the legs of the volleyball players can also be used neuromuscular exercises to prevent injury and help to modify the mechanical movement of the attack hit .The research sample was of 8 players of volleyball patients with a history of the knee and ankle. The researcher used the experimental method and designed a neuromuscular exercise program lasting for six weeks to improve the performance of motor skills; the attack hit was filmed by a Panasonic camera to determine the speed of approach and flight time and the vertical jump and the angle of the knee before the jump and after landing. The strength of the muscles of the legs and back and the balance of neuromuscular were also measured.

Measurements of the Study:

- Running 18 meters per second
- Japanese test
- Three jumps longitudinal
- Strength of legs muscles
- Strength of back muscles
- Jump from the running of the attack
- The attack hit
- Approach
- Vertical jump
- Flight time
- Angle of the knee before the jump
- Angle of the knee after the jump
- Balance

Data Analysis: SPSS for Windows, version 19 was used for statistical analysis.Mean, Median, Std. Deviation, Std. Error of Mean, Skewness, Std. Error of Skewness, Mean Rank, Sum of Ranks and Z score. Wilcoxon Signed Ranks Test were used.

RESULTS AND DISCUSSION

Table 1 shows the mean and standard deviation, median age, height, weight and age of the injury history.

Table 2 shows the mean, Median, standard deviation for the research variables

Table 3 shows the mean, standard deviation, minimum and maximum for the research variables. Table 4 shows the mean rank and sum of ranks for the research variables.

Table 4 shows z score and Asymp. Sig. (2-tailed) for the research variables.

- Based on positive ranks.
- Based on negative ranks.
- Wilcoxon Signed Ranks Test

Table 1: Statistics

	N Valid	N Missing	Mean	Median	Std. Deviation	Skewness	Std. Error of Skewness	Minimum	Maximum
Age	8	0	21.6250	21.0000	1.50594	.518	.752	20.00	24.00
Length	8	0	185.5000	186.5000	4.03556	-.835-	.752	179.00	190.00
Weight	8	0	79.3750	79.0000	4.06861	.317	.752	74.00	85.00
Injury History	8	0	6.3750	6.5000	.74402	-.824-	.752	5.00	7.00

All values are confined between +3 indicating the homogeneity of the research sample in age, height, weight, age and training.

Table 2: Descriptive Statistics

	N Valid	N Missing	Mean	Median	Std. Deviation	Skewness	Std. Error of Skewness
Running 18 meters per second	8	0	3.4063	3.4250	.14861	-.537-	.752
Japanese test	8	0	8.6675	8.8000	.23420	-1.631-	.752
Three jumps longitudinal	8	0	7.3500	7.3500	.46291	.000	.752
Strength of legs muscles	8	0	166.7500	175.0000	30.96427	-.356-	.752
Strength of back muscles	8	0	147.5000	150.0000	11.33893	-.441-	.752
Jump from the running of the attack	8	0	2.8375	2.8000	.06944	.587	.752
the attack hit	8	0	37.1250	36.0000	2.94897	.907	.752
Approach	8	0	2.4150	2.3500	.24524	.581	.752
Vertical jump	8	0	86.5338	86.3000	3.70078	.260	.752
Flight time	8	0	.7125	.6800	.10292	2.195	.752
Angle of the knee before the jump	8	0	121.0000	120.5000	3.20713	.520	.752
Angle of the knee after the jump	8	0	98.2500	99.5000	2.43487	-1.178-	.752
Balance	8	0	4.6250	4.5000	.74402	.824	.752

Table 4: Ranks

		N	Mean Rank	Sum of Ranks
Running 18 meters per second	Negative Ranks	8[a]	4.50	36.00
	Positive Ranks	0[b]	.00	.00
	Ties	0[c]		
	Total	8		
Japanese test	Negative Ranks	8[d]	4.50	36.00
	Positive Ranks	0[e]	.00	.00
	Ties	0[f]		
	Total	8		
Three jumps longitudinal	Negative Ranks	0[g]	.00	.00
	Positive Ranks	8[h]	4.50	36.00
	Ties	0[i]		
	Total	8		
Strength of legs muscles	Negative Ranks	0[j]	.00	.00
	Positive Ranks	8[k]	4.50	36.00
	Ties	0[l]		
	Total	8		
Strength of back muscles	Negative Ranks	0[m]	.00	.00
	Positive Ranks	8[n]	4.50	36.00
	Ties	0[o]		
	Total	8		
Jump from the running of the attack	Negative Ranks	0[p]	.00	.00
	Positive Ranks	8[q]	4.50	36.00
	Ties	0[r]		
	Total	8		
The attack hit	Negative Ranks	0[s]	.00	.00
	Positive Ranks	8[t]	4.50	36.00
	Ties	0[u]		
	Total	8		

Table 4: Continue

		N	Mean Rank	Sum of Ranks
Approach	Negative Ranks	0[v]	.00	.00
	Positive Ranks	8[w]	4.50	36.00
	Ties	0[x]		
	Total	8		
Vertical jump	Negative Ranks	1[y]	1.00	1.00
	Positive Ranks	7[z]	5.00	35.00
	Ties	0[aa]		
	Total	8		
Flight time	Negative Ranks	0[ab]	.00	.00
	Positive Ranks	8[ac]	4.50	36.00
	Ties	0[ad]		
	Total	8		
Angle of the knee before the jump	Negative Ranks	0[ae]	.00	.00
	Positive Ranks	8[af]	4.50	36.00
	Ties	0[ag]		
	Total	8		
Angle of the knee after the jump	Negative Ranks	0[ah]	.00	.00
	Positive Ranks	8[ai]	4.50	36.00
	Ties	0[aj]		
	Total	8		
Balance	Negative Ranks	0[ak]	.00	.00
	Positive Ranks	8[al]	4.50	36.00
	Ties	0[am]		
	Total	8		

Table 4: Test statistics[c]

	Z	Asymp. Sig. (2-tailed)
Running 18 meters per second	-2.524-[a]	.012
Japanese test	-2.524-[a]	.012
Three jumps longitudinal	-2.527-[b]	.012
Strength of legs muscles	-2.552-[b]	.011
Strength of back muscles	-2.539-[b]	.011
Jump from the running of the attack	-2.539-[b]	.011
the attack hit	-2.527-[b]	.012
Approach	-2.533-[b]	.011
Vertical jump	-2.383-[b]	.017
Flight time	-2.533-[b]	.011
Angle of the knee before the jump	-2.527-[b]	.012
Angle of the knee after the jump	-2.585-[b]	.010
Balance	-2.539-[b]	.011

The researcher applied a neuromuscular exercise program consisting of 6 weeks, 3 units per week 30 minutes per unit and each unit consisting of 10graded exercises. The program work to improve the level of muscle strength of the muscles of the legs, back and vertical jump ability has also helped to improve motor speed. It also helped to improve the performance of attack hit through aggressive approach and improved vertical jump and a time of flight and accuracy of the strike offensive. Also, improved muscle strength of the legs and the back has helped to change the angles of the knee before and after the jump, which had a low impact on the compression on the knee when you jump and after landing, low level of pain. The neuromuscular exercises played a positive and effective role in improving the level of balance, which had a great impact in the good performance of the landslide hit attributed to increase the strength of the ligaments of the knee and ankle ligament.

CONCLUSION

Neuromuscular Exercise Improved:

- The mechanical movement of the attack hit.
- The level of improvement in muscle strength of the legs and back.

- The balance of the neuromuscular volleyball players

Recommendation:

- Neuromuscular exercises work to improve the performance of the attack hit
- Neuromuscular exercise prevents injuries and back legs.
- The researcher recommends using exercise to improve neuromuscular efficiency of the joints of the human functional.
- Neuromuscular exercises help to modify the mechanical movement of the various sports games.

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