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Research Article

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A comparison of the effects of three types of plyometric, balance and combination training on ankle proprioception

Elham Zali[1], Behzad Jahangiri Esfahani[1*] and Meisam Danesh[2]

[1]*Department of Sport Injury, Khorasgan (Isfahan) Branch, Islamic Azad University, Department of Physical Education and Sport Sciences, Isfahan, Iran*
[3]*Rashel Sefe Idea Consulting & Engineering Co, Isfahan, Iran*

ABSTRACT

The purpose of this study was to compare the effects of three types of plyometric, balance and combination training on ankle proprioception. Sixty students of University of Mohajer Isfahan (mean ±SD; age 24/9± 4/3 year , weight 74±4/8 kg and height 1/72± 8/2cm) voluntarily parti cipated in this study. Subjects randomly were divided into four plyometric, balance, and combination training and control groups. All subjects were tested ankle angular reconstructions in 5, 10 & 15 angles of ankle proprioception star test. Three experimental groups performed their training programs for duration of eight weeks (three sessions per week).After eight weeks performed post test .Data were analysed using unilateral variance and LSD post hoc test. All analyses performed on SPSS 16 software. Results of this study showed that, The effect of pre-test training on post- test training was significant in ankle proprioception avrzhn 15 ° (F(59,1) =28/9 and P=0/001) and inversion 10 ° (F(59.1) =21/75 and P=0/001) and the others was meaningless (p>0/05). Also interaction between test sessions in group was significant proprioception variable in all degrees and two forms avrzhn and inverzhen (p≤0/05).It can be concluded that the combination training can be suggested as a good program for achieving to the highest effectiveness in ankle angular reconstruction as well as use of balance training for improvement of angular reconstruction.

Keywords: Proprioception, plyometric training, Balance training, ankle.

INTRODUCTION

In spite of sport principles in obtaining the fitness & preparing the equipment's to precise & deliberate legislation & regulations, it does not obstacle the sport hurt, but can be tried in decreasing them. So, regarding to that the in different sports can be specified the factors caused hurt & also each sport needs to the different fitness & mental skills which they are specified by coaches & also needs to the knowledgeable people in sports medicine professionals, physiotherapies & Sport-Education students & that prevent the repetition of hurts by knowledge & investigating the causes of injuries in sports & recognition of the type of fitness training before the event.

Two kinds of risk factors involve in sport hurts that include; intrinsic & extrinsic factors. Also one of the intrinsic characteristics of individual risk factors includes proprioception & balance. Proprioceptive sense is known as jointed sense that a person informed of the position & motion acts & eventually, caused to the motion & strength of the muscle contractions. Also proprioceptive sense as controlling factor in the chain of sensory proprioception & postural muscle movement plays a special role in muscle. Disorder in this sense is considered as a one of the most important disorder in posture & balance [1].

Ankle joint due to the body weight & variety of movement is very important. The joint is provided the ankle's strength by soft tissue & ligaments. Proprioceptive acuity is required, especially in the ankles; maintain joint function properly during daily activities, exercise & motor skills. The inability of the ankle joint proprioception cause to alter the motor coordination & motor patterns such as increasing since the beginning of the contraction of the muscles around the joint & reduce the scope of their contract, & likely caused to increase the ankle sprain. Each factor that reduces the sense of depth, can be mechanical instability, finally, the joint is prone to injuries & minor damage. In addition, the joint with ligament lesions inversely decreases joint proprioception [2].

Regarding to the above & also acceptance the proprioception & balance, they are the most important indexes in the prevalence & incidence of sports injuries, the researcher tried to measure the effects of exercises on ankle joint proprioception development & dynamic balance by different training methods; plyometric exercises, balance training & plyometric exercises combination & balance on non-athlete male students.

EXPERIMENTAL SECTION

Research project

The effect of the independent variables (plyometric exercises, balance & combination) on the dependent variable (proprioceptive ankle) were evaluated in this research, this study is among the experimental & was done as field research.

Population, sample & sampling

The population included male students in Isfahan Shahid Mohajer University that they were 60 persons as volunteers; the sample volume is considered as 15 persons in each group (totally 3 groups) which they did 8 weeks exercises & 1 group did their daily activities as control group. In this study, the samples are selected & then all samples were justified on about tests & completed consent form, then randomly assigned to one of four groups. The participants are selected among 19-27 years old persons among Isfahan Mohajer University. None of the subjects had a history of lower extremity orthopaedic injuries. In addition, in the test day, they didn't use any drug, alcohol & smoking & supplements.

Research Tools

Ankle proprioception measuring instruments

The device consists of two independent plates: the top plate from 0 to 45 degrees to the left & right which graded for inversion & eversion & the zero is placed in the middle of plate for the beginning point of eversion & inversion, the down plate is the measuring index & is the supporter for top plate. Upper dial indicator also has two indexes, one at the bottom of the heel & the other in the middle of the plate & the zero point & the position of the feet (Figure 1).

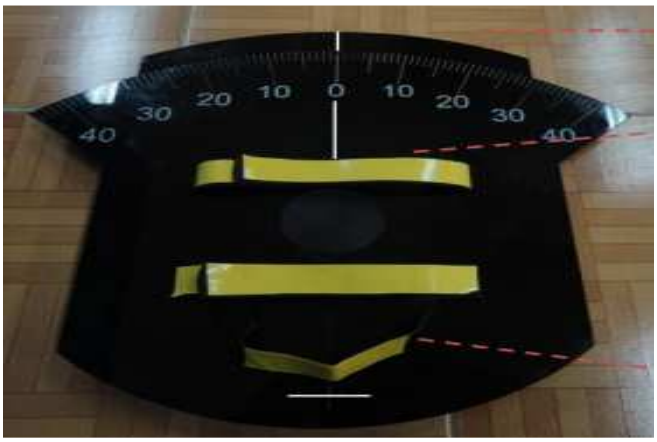

Figure 1: Goniometer (Square Km) & its components

Given that the device also has straps, in a situation that straps are closed on the leg & feet placed entirely on measurement, the tool measures ankle abduction & adduction. If not using the strap & heel position on the index & second finger in one direction, & index finger placement of the foot measures the inversion & eversion.

To measure by this instrument, after subjects performed a few moves to warm up & then participants are seated on a chair so that the knee is flexed 70 degrees in angle. The subjects took out their shoes & placed his foot on the Goniometer (Square Km) while his ankle plantar flexion at 20°C, for measuring the angels was used simple Goniameter (Square Km) then, the subjects tied straps on his feet Goniometer. This instrument can be rotated to inversion & eversion, based on the basic axial can be showed the rotated angel.

Subjects placed their foot on it as determined index was in the central of it & second toe was on the central index of Goniameter.

Figure 2: the manner of sit down & rest foot on Goniameter

For measuring joint position sense was used Reproduction of Active Position Sense in this research. Foot randomly led by the tester to a target angle 5, 10 & 15 degrees, the target angel position is held for 5 seconds & then returned to zero degree angle (Figure). Then the participants were closed their eyes by blindfolded to prevent visual feedback, & eventually he was asked to repeat the active angle of the target with your eyes. It is for each leg of each angle was done three times consecutively & the difference between the target angles was considered as joint position sense ankle.

RESULTS

Table (1) shows that the results of statistic analysis of effects of subjects internal group. The first row shows that when the scores mean are compared among pre-test & post-test, there was significant differences (P=0.00), second row shows that changes interaction within the group (slope change) is also significant (P=0.00). In other words, when changing between each of the three groups are considered as separately, the significant level will be increased & also the pattern of changes within groups are considered different.

Table (1): Intral-group analysis of the impact of the variable proprioception

Resources	Total square	Freedom rate	Squares mean	F	P
Testing time	26.13	1	26.13	28.9	0.00
Interaction testing time	18.33	3	6.11	6.77	0.001
error	50.5	56	0.90		

Table (2) shows the differences between the different research groups over the two tests that they are not significant decisions (P=0.28). The different among groups in different groups in research are matched up during the two tests.

Table (2): Hypothesis testing the effect of changing variables between the groups in proprioception

Resources	Total square	Freedom rate	Squares mean	F	P
Cut place	418.13	1	418.13	456.14	0.00
Interaction testing time	3.53	3	1.17	1.28	0.28
error	51.33	56	0.91		

CONCLUSION AND DISCUSSION

In connection with the discussion of proprioception must be stated that physical activity improves proprioception, however the lack of activity leads to weakening of proprioception. The studies that were done on the elderly showed that older people who exercise regularly have better proprioception than better who don't exercise [3].

Also activity caused to improve neuromuscular system & increase physical activity & muscle strength, even if the exercise is no pressure on muscle & is done in the complete movement patterns (a movement in the full range of motion) maybe increase the body reliance to the information afferent from sensory receptors & also increase environmental sensitivity which resulted in improved proprioception & balance. Immobility & inactivity leads to decreased afferent signals from receptors in the proprioception.

The recent findings are same as researches results that were done by Zamani (2010), Moslemi & et al (2005), vuillerme & et al (2001), Hang & Chen (2004) & they are not same as Coughlan (2007). [4, 5, 6, 7, 8].

Also the physical activities caused to the neuromuscular system & also increased the muscles` strength & if the sport activities were done without any pressure on the muscles & were done in the perfect movement pattern (a movement was done in the full range of other movement). May be increased the reliance to afferent information from sensory receptors & peripheral sensitivity that resulted in improved proprioception & balance. Immobility & inactivity leads to decreased afferent signals from receptors in the deep.

The recent research results are same as Zamani (2010), Moslemi & et al (2005), vuillerme & et al (2001), Hang & Chen (2004) & are not same as Coughlan (2007). [4, 5, 6, 7, 8]. Zamani (2010) studied on the balance exercises, plyometric & compound exercises on the knee proprioception that refers to different effects on the activation factor of knee angle & also shows absolute error reconstruction. The results of research showed that the impact of balance training, plyometric on knee proprioception combination is more effective also, in the present study found a combination of exercises more effective than others. Volume & et al results were so complete results; Efficiency & balance process efficiency can be improved with specific exercises [4]. Moslemi & et al (2005), It pointed out that plyometric exercises can be tailored It pointed out that plyometric exercises can be tailored deep impact It pointed out that plyometric exercises can be tailored proprioception [5]. In other h&, Coughlan (2007) didn't observe positive effect of neuromuscular training on the ankle rate. Also there were not so much similarities between two researches. So probably if the study evaluated the proprioceptive, the results were similar[8].

The findings should be said in explanation of several recipients to receive information about proprioception & joint position sense are involved; the receptors, the receptors on the muscle, tendon receptors & receptors of the skin. In most research, the muscle spindle is known as primary source of proprioceptive information sees [9]. In this case, more massages are provided muscles receivers. Skin afferents involved in proprioception for joint movement, cause skin deformation of the joint & causes the skin to become active terminals, in fact, a wide range of skin receptors are the active during voluntary movement. Also, when the sense of touch is stimulated statues sense is increased, in general, muscle afferents & possibly organ injuries are early proprioceptive receptors & appear to be a joint position sense comes primarily from the receptor muscle & tendon & then they was derivate the building of the capsule, ligaments & skin & subcutaneous tissues of stems, This is one of the reasons for choosing the three angles of 5, 10 & 15 degrees to measure the ankle proprioception because this angle the role of muscles & tendons are different from the role of ligaments & skin capsule.

Muscle fibers are activated when a person practices & activities organized by the muscle spindles. Muscle spindles are specifies the amount of work that the muscles need to work means that the frame of stimulus can be ordered neuromuscular stimulation system, a mechanism to improve joint position sense can be exercised by muscle spindles, by increasing output through the gamma communication channel during the movement. Nerves, skin, joints & nerves to answer their most vigorous activity, while muscle spindles provide the comprehensive in about across the worlds physiological motion, therefore, ligaments, nerves, muscle capsule receiver both have an important role in joint stability [10]. When muscle spindles dragged muscle depolarization nerve endings. In parallel with muscle fibers are the muscle spindles, muscle tension in the afferent impulses are caused by the action potentials in the afferent & dorsal root of spinal cord moves through it. The message send to the cerebellum cerebrospinal & used for coordination. Sensory information produced by the joint mechanoreceptors of nerves & enters the spinal cord dorsal root after the dorsal root sensory goes to the cortex via the thalamus [2]. In previous

studies were found that muscle spindles & Golgi tendon organ in the terminal domains are in the highest sensitivity. Therefore, the absolute proprioception error & the effect of exercise on proprioception error is the lower than mid-rage in the muscles end-rage [11]. It is perhaps for this reason that the study of eversion & inversion of 15 ° were effective in all kind of exercises, But in the angle of 5 degrees for balance exercises failed to show the desired effect. It is more appropriate to explain the need for research in different angles. In other words, the angle 15 ° angle error rate is lower than 5 degrees proprioception & thus more influence has been made at an angle of 15 degrees.

In study that was done by Moslemi & et al (2005) the participants included 63 healthy women in three groups; non-athletes, athlete with jumping exercises & athlete without jumping exercises. The results showed that jumping exercises & activities are effective to strengthen the ankle joint proprioception. According to the results of active & non-active reconstruction angle combination & balance exercises have most effective & enhance [5]. vuillerme & et al (2001) compared on the ankle proprioception with the foot pressure center movement gymnasts with non-gymnasts athletes (football, tennis & handball). They measured ankle joint proprioception input & vibration antagonist muscle ankle. Based on this research; gymnasts can be used (fast) proprioceptive information to reduce the movement of the foot pressure. These results show that the performance & efficiency of the process of balance could be improved with specific exercises [6].

Verhagan (2004), Konradsen & et al (1998), Hiller (2004), Akbari (2003) reported the loss of balance & proprioception after ankle sprain [12, 13, 14, 15]. According to the results of this study can be a main reason for the relationship between proprioception & balance & interaction between these factors. Position in relation to gravity & the environment is felt by a combination of visual, auditory & somatosensory input. Balanced exercises included; ankle & knee & hip movements that coordinated by the chain of controlled movement. All of these trends are essential for fluid movements & coordinate sport [16].

Static & dynamic balance are based on the interaction between the body & the environment, regarding to the clinical point of view sensory & motor processes balance in the sense that a person could be due to one or two reasons impaired balance; 1- the center of gravity over the base of support is not feeling well 2- automatic movement needed to move the center of gravity are not done in the correct time & it is not efficiently [16]. Arc reflex & muscle control mechanisms to affect posture. Minor & total injuries are reduced the afferent reflex models. Therefore, joint position sense is reduced, increased postural sway & balance disappears, A mechanism to improve joint position sense can be exercised by the muscle spindle by increasing output through communication channel gamma is in motion [10]. In at all, the results of research showed that combined, plyometric & balancing exercises have highest effect on proprioception.

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