



Effect of Dynamic Stretch and Continuous Ultrasound Wave of Achilles Tendon and Quadriceps Tendon on the Power and Flexibility of Male Footballers

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ABSTRACT: The Effect of Dynamic Stretching and Continuous Ultrasound on Achilles Tendon and Quadriceps Tendon on Power and Flexibility in Male Soccer Players. **Introduction:** The importance of appropriate physical fitness prior to sports competitions is clear for sport and healthcare Specialists. The importance of athletic Skill performance has a specific role in achieving best results with successful achievement and also to prevent imposing economic defaults in Sport through promoting the Physiological and Biomechanical parameters. **Aims:** The current study is a conjoined research from Rehabilitation and sport sciences fields regards using certain medical modalities and specific planned programs on some Physical characteristics in athletes in order to record their practical results and effects on some specific performances which are effective in competitions. Moreover in this study we want to make these effects and changes to be a reliable guideline to professional performances in professional tournaments. **Methods and Materials:** Twenty professional players with average age of 26 years old who are currently involving in Iranian football league participated in this research. After 5 minutes warm up, Knee flexion and Ankle Dorsiflexion motion of range of both knees and ankles were measured and results were recorded also the Sargent test for all athletes were done and results were recorded too. Continuous Ultrasound, Dynamic stretching and integrated method (US+ Dynamic Stretch) were used for all 20 players respectively, and after applying of each one Sargent test and ROM measurement of Knee flexion and Ankle Dorsiflexion were recorded again for every athlete. **Results:** After doing K-S test and having normal data distribution, Paired T test was done for pre and post data. Meaningful difference between pre and post data of Sargent test performing for U.S was not found ($P=0/065$). But in the other both methods, Dynamic Stretching and integrated method, meaningful difference was found ($P=0/00$), ($P=0/00$) respectively. For pre and post data of Knee and Ankle flexibility for all three methods meaningful difference were achieved. **Conclusions:** What follows from this study is the role of professional preparation should be considered not neglected and ignored. And it is better that importance of integration of training and rehabilitation protocols, as well as cooperation of rehabilitation teams and Sport sciences experts already to be considered for sport specialists. What is obtained from this study indicates the positive effect of integrated method of U.S and Dynamic Stretching than ultrasound or dynamic stretching alone and also the better ratio in results after dynamic Stretching than continuous ultrasound in the both variables, flexibility and power in athletic performances, which reflects this fact, the professional preparation before sports events can be associated with positive results.

Kew words: Dynamic Stretching, Continuous ultrasound, Achilles tendon, Quadriceps tendon, power, flexibility, Adult soccer players

INTRODUCTION

In today's world of professional sports and tough global campaigns, observance of professional principles comes first. What is certainly occurring in the world of professional sports is dramatically different from what is happening in Iran, in terms of both benefiting from

the advanced equipment and technical cadres with updated scientific capabilities. Developed countries in sports sciences such as Australia, Canada, the US, and China have achieved excellent results in international levels of sports fields by taking advantage of modern science in sports.

The need for implementation of professional protocols of physical fitness on contractible and flexible organs of the body which leads to improved performance sports skills is something very important and undeniable in today's world. Flexibility and power of the body are of factors which play a major role in prevention of injuries, improvement of performance, gaining the desired results in sports fields among the athletes. Hence, considering these two important factors in a sport like football could lead to obtaining better results and prevention of injuries. Having an appropriate flexibility, motion of range, and sufficient muscle strength leads to the prevention of sports injuries and increased strength of athletes (Fakhari, 2011).

Some biomechanical and physiological parameters in human body play an essential role in professional performances. Tendon-ligamentous and muscular-articular structures of the human body can be promoted under different conditions by doing some training interventions. Improvement in these features can lead to improved professional performance. Familiarity with the professional biomechanics of the body and pathobiomechanics provides the ability to identify and recover some of the disorders. However, accurate and appropriate assessment of flexible components of the human body requires functional training that is definitely important and undeniable to the experts of sports science and rehabilitation. Understanding the relation between performance and implementation in different level of human body and the effect of this relation on professional performance generally requires biomechanics of the muscular system. In addition, pathobiomechanical study of these relations can make it easy for a biomechanist in understanding the causes and reasons for the bad or good performance of a skill through being aware of the existing injuries and the different between the biomechanical health or inefficiency of a system (Talebi, 2013).

Studying the relationship between the contractible parts of the body in terms of flexibility based on some abilities is something that has repeatedly occurred and still continues. Measurement of the impact of interventions on professional performance of athletes and generalizing it to the community of professional athletes is of special importance in sports sciences like other areas of science. Measurement of some parameters in anthropometry and kinanthropometry can be effective in the study of the effect of these relations on performance. In addition, familiarity with practical tests and the effect of an athlete's preparedness on performing these tests are important and have an important functional position (Hadavi *et al.*, 2011, Delavar, 2012).

Some executive skills of athletes, especially in a sport like football, have an undeniable relation with some features of contractible and flexible tissues of the body. Heading is one of the executive techniques in football

in all areas of performance of a footballer in the defense, attack, and even when moving in different regions of the playground. Good and effective implementation of this technique is closely related to the ability of the athlete in the Sargent test. This test measures the functional strength of an athlete when running the vertical high jump skill which shows the strength of lower extremities muscles in a closed chain of performance (Esmaeili, 2000).

The effect of some training interventions on structural features of contractible parts of the body such as increased elasticity of tendons, muscles, and ligaments caused by dynamic stretching is of undeniable physiological principles of exercise which is achieved through intra-structural changes in organs such as Golgi organelle and muscle spindle and can lead to improved performance after applying the dynamic stretching on the tendon. This is of basic and underlying principles of plyometric exercises (Shadan, 2000). Several studies have reported the effect of dynamic and ballistic stretching on increased flexibility and improved motion of range in joints. However, some studies frequently corroborated the definite impact of stretching exercises on improvement of performing a skill. Some other studies have reported non-superiority of some exercise protocols over each other in skill performance and motion range (Ghaitasi, 2008, Aubi Avaz, 2013).

In addition to the use of training interventions and preparation of athletes by specific exercises in order to reach better performance with less energy consumption and lower rate of vulnerability, the use of some rehabilitation tools and equipment can play the role of a supporter and supplement in achieving this goal. Ultrasound therapy is one of the important tools in rehabilitation and physiotherapy which produces ultrasonic waves in the therapeutic range (pulsed and continuous). Continuous wave has the thermal ability with increasing the movement of small molecules in flexible tissues such as muscles, tendons, ligaments, and skin. This wave can increase the flexibility of these tissues and finally leads to improved motion range of the joints surrounded by these flexible tissues (Bakhtiari, 2001, Robertson *et al.*, 2006).

Materials and methods: In this study, 20 trained footballers playing in the First Division were participated. In a plenary session, the subjects were briefed on the performance of Sargent test and the way of measuring the motion range of the knee and ankle using a digital goniometer. According to the protocol of Hogh *et al.* or Yamaguchi *et al.*, the subjects were asked to slowly walk on a treadmill for 5 minutes at a speed of 2 to 4 meters per second in order to warm up the body and prepare the muscular and cardio-pulmonary systems. This protocol has been extracted from principles of exercise in clinical biomechanical studies (Richards, 2008, Payton and Bartlett 2008).



Fig. 1. (a). Ultrasound to Achilles and quadriceps tendon, (b). Measuring the angle of knee flexion and ankle dorsiflexion using a digital goniometer.

Then, for recording the active motion range of both lower extremities joints (Kendall *et al.*, 2005), the knee and ankle joint angles were measured using a digital goniometer provided from Sharif University of Technology. The mean range in every right and left joint by dividing the total value by two. Sargent test was performed after each time of measuring the motion range and the results were recorded. To evaluate the effectiveness of treatment and rehabilitation modalities, three protocols of continuous ultrasound wave of Achilles and quadriceps tendons, dynamic stretching, and a combinative method of continuous ultrasound

wave and dynamic stretching on Achilles and quadriceps tendons were applied in three steps After warming up on the treadmill, the above-mentioned angles were measured and the Sargent test was performed. After running any protocol, angles of knee flexion and ankle dorsiflexion were again measured and the Sargent test was performed. To ensure that there is no overlapping effect of three methods, an interval of one day between ultrasound and dynamic stretching methods and an interval of 3 days between dynamic stretching and combinative methods were considered (Denegar *et al.*, 2010, Karageanes, 2005).



Fig. 3. The ultrasound produced by Novin Company.

1. Continuous wave ultrasound protocol:

Flow mode: Continuous wave, Frequency: 1 MHz, Duration of applying the current on the tendon: 5 minutes, Total duration of applying the intervention on four tendons of left and right: 20 minutes

2. Dynamic stretching protocol:

The mode of applying the stretching: active
Status of applying the stretching: start for running
Type of stretching: dynamic
Number of stretching: 15 stretching for 2 seconds and a total of 30 seconds for the left and right

3. Combinative method protocol:

- A) Applying the continuous wave ultrasound on each tendon for 5 minutes and total of 20 minutes for all four tendons.
B) Applying the dynamic stretching in the 2-step way

Data and field results: The results of the present study show the effectiveness of the damage caused, prevent and improve the implementation of sports skills. What obtained from the effect of continuous wave ultrasound on Achilles and quadriceps tendon showed no significant difference between the pretest and the posttest ($P = 0.065$). However, its impact on flexibility of Achilles and quadriceps tendons reveals a significant difference between the pretest and the posttest ($P = 0.00$).

But, in dynamic stretching and combinative method, there is a significant difference between the pretest and the posttest in the results of Sargent test. This indicates the effectiveness of both methods on the performance strength ($P = 0.00$).

Also in pre and post-test flexibility on both knee and ankle fusion procedure and method of dynamic tension, there was significant difference between results ($P = 0.000$).

DISCUSSION AND CONCLUSION

What comes from the research and field content of the present study reflects the fact that there is no doubt the effect of exercise protocols in exercise science, what science and the laws and rules of exercise physiology and biomechanics of sport is proven and undeniable no beneficial effect on the implementation of professional skills in the fields of performance. What continuous wave ultrasound intervention leaves on structures such as muscle contractility, tendons and ligaments of the joint motion of range and flexibility is effective and useful in performance. The fact that why it has not put positive impact requires more studies about the mechanism that should be a better output power transmission actuator arm muscle and muscle to muscle junction to improve and optimize energy efficiency by spending less energy and do a better job done. Why continuous wave ultrasound is applied to the two tendons with a significant increase was seen in the samples under study thought the team might arguably two of the duration and severity of the cases that could present study on the results of the intervention make a positive impact.

The results obtained integrated method of dynamic tension indicate the positive effect of the two methods and properties of strength and flexibility in both physiological and biomechanical justified on the basis of certain principles and discussed. Continuous wave ultrasonic current, by creating local heat at the desired tissues (Achilles tendon and quadriceps) and increasing their flexibility, along the dynamic stretching applied in the combinative method, by improving the performance of muscle spindles and Golgi organelle that had achieved better performance through a heat recovery and increased local blood circulation, led to better results in comparison to mere dynamic stretching. This justifies the causes of acquiring better results compared to previous interventions. It seems that if dynamic stretching is applied with a deep heat ultrasound protocol on Achilles tendons and quadriceps, it can both improve the motion range and muscular strength.

In general, this study showed that in the case of simultaneous use of two methods in combination, the results of this intervention on muscle strength and motion of range and flexibility of affected joints fusion method is far better than using any of the methods

alone. This emphasizes the importance of combining the treatment and rehabilitation methods and exercise science. The authors recommend other researcher to study the combination of rehabilitation methods and exercises in other sports.

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