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A COMPARISON OF THE PROPRIOCEPTION OF SHOULDER JOINT IN HEALTHY AND INJURED SWIMMERS

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ABSTRACT

The purpose of this research was to make a comparison of the shoulder joint proprioception in healthy and injured swimmers. For this purpose, 15 healthy swimmers (with the average age of 18.87 ± 1.97 years, height of 184.38 ± 3.69 centimeters and weight of 84.06 ± 5.81) and 15 injured swimmers (with the average age of 19.26 ± 2.57 years, height of 183.6 ± 5.74 centimeters and weight of 87.66 ± 5.88) participated in this research voluntarily. The method of the job was in this way that first the consent form was completed by the examinees. Then the tests of (height, weight, external rotation range of dominant shoulder) were made for measuring the individual characteristics, studying the range of movement of external rotation and proprioception of the dominant shoulder accordingly. In order to analyze data, the descriptive statistics (mean and standard deviation) and independent t-test at the significance level of $p \leq 0/05$ was used using SPSS 18 statistical software. Results showed that there is a significant difference between the range of external rotation movement and the angle reposition error of shoulder in healthy swimmers and the similar shoulder of the injured swimmers; however, there is no significant difference between the thresholds of sensing their shoulders 'movements.

Keywords: *Proprioception, Shoulder Joint, Healthy Swimmer, Injured Swimmer*

INTRODUCTION

Now a today, with the daily increase of the participation of individuals in competitive and recreational sports, the rate of emergence of joints damages has had a noticeable increase (According to the research Ma Worther, 2002). However, according to some people, swimming is an ideal form of a sport far from any sport injuries, because swimming is among the sports which in the components of exercise and environment are different from the other prevailing sports in the land (According to the research of Mousavi *et al.*, 2003). For this very reason, though it seems that the physical problems and damages, emerge only due to competitive and intensive exercises on the land, but it has been observed that the emergence of micro injuries and more than frequent in swimming causes the creation of damages such as swimmer' shoulder (According to the finding of Mach Master, 1996). Thus, identifying the mechanisms involved in damage and finding a solution to prevent from the injuries have always been noticed by experts, trainers and sportspeople. In this regard, one of the cases which have a considerable role in optimal performance of sport skills and prevention from damage is proprioception (According to the finding Hrysomallis, 2008). Awareness of each individual from his/her own body and its link with the surrounding environment is called joint position sense of proprioception. The receptors of this sense exist in muscle spindles, Golgi tendon organs, ligaments, joint and skin. The information is disseminated through thick myelinated fibers whose cellular bodies are located in the knots at the back root of backbone (According to the research Mirbagheri *et al.*, 2000). The data provided by the proprioception helps with the precise and fine movement and supplying active stability (According to the finding Riemann and Lephart, 2002). Also this sense has a great role in keeping the balance (According to the research Alizadeh *et al.*, 2012). This sense through muscular reflexes has a protective role in prevention from intensive damages (Haber and Wels, 2006). Their importance is to the extent that according to the research Zazulak *et al.*, (2007) have stated that the sports women who are facing with the reduction of proprioception in the body and lower organs, are exposed to the damage more than other sportspeople. Also the messages of proprioception from joints cause the informed assessment of cortex from the rate of pressure applied on joints and the situation of each of the joints. During the movements, receiving the

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feedbacks of proprioception, the system of central nerves brings into action the muscular system in order to create a dynamic stability efficiently (According to the research Barack *et al.*, 1989). However, the damage of proprioception creates diverse disorders in the joints. It is such that the inputs of this sense are facing damages.

(McWorther, 2002) which leaves unfavorable effects on body situation, balance and nervous-muscular coordination in the whole body. Despite the presence of this sense, the nerve system is able to give a fast response to the input data in form of muscular contraction. In addition to it, the pressures imposed on joints and ligaments are moderated and amended by this sense. Consequently, the creation of sufficient stability in the body is not only subject to muscular power and endurance, but it needs other factors such as coordination and balance which are supplied through proprioception (According to the research Lephart, 2000). Thus, proprioception has a very important role in prevention from damage and this has made healers pursue method which could improve the proprioception. That to what extent this sense is facing damage in different fibers and that what kind of changes this sense finds in different joints are questions which demand further research.

One of the important joints of the body is shoulder joint which is very important in the sports in which the hands have a throwing movement such as various kinds of throwing, swimming, etc. The throwing motions over the head, is a complex and very skillful movement which due to the intensive forces applied by the throwing athlete imposes extraordinary stress on shoulder joint (According to the research Lephart, 2000).

The throwing shoulder should be loose enough to give an intensive external rotation to the shoulder joint and to be sufficiently stable to prevent from the semi-dislocation of shoulder joint which is one of the most prevailing cases of joints dislocation in human body (Lephart, 2000). The performance stability of the shoulder is the result of mutual link between static and dynamic stabilizers which this link is created through the kinetic-sensory system (proprioception). Today, proprioception is an important part in the rehabilitation of sport damages (Myers and Lephart 2000). The joints damages can have impacts on proprioception and disrupt the natural nervous-muscular reflections which are to protect the joints (Carson, 1989).

Proprioception is of significance in the dynamic stability of throwers' shoulder joint with regard to the noticeable loosening state of joint capsule and their excessive moving scope (Mirdar, 1993). So, as it was announced, proprioception, as a result of different sports may afflict with damage and thus brings about different problems for the human. However, the general belief is that swimming, due to the fact that it is practiced in a totally different environment and without applying a pressure on the opponent, and on the other side, this sport is one of the most prevailing methods in rehabilitation period, so swimmers will face less damage and fewer problems are created for them.

Thus, what made the researcher conduct a comparison between the proprioception of the shoulder joint in healthy and injured swimmers were as follows: -The importance of proprioception for individuals on one side and the role of shoulder joint in swimming sport on the other side, That the exercises of proprioception today are important parts of joints damages rehabilitation and can be put forth as one of the preventive strategies in professional sportspeople including swimmers exposed to joint damages such as shoulder -That reviewing the researchers performed inside or outside the country, no research was found about this topic -That the environment of swimming as compared with other prevailing sports is different, also difference in practical obligations

-That damage is an indispensable part of sport -The importance of specification of mechanisms involved in damage -Lack of availability of sufficient information about the difference of proprioception in healthy and damaged swimmers and whether or not healthy swimmers have a better proprioception as compared with damaged swimmers It is hoped that using the results of this research, it will be possible to have a better view of the role of proprioception in swimming and its changes as a result of damage. This will enable us to help with their exercise program and prevent them from further damage. Consequently, it will be possible to have a clearer image of this sport and use them in the rehabilitation period to heal the damages of this field and other sports fields.

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MATERIALS AND METHODS

Methodology

The present research is an applied research and of the type of case study and standard group. The statistical population of the present research is comprised of professional swimmers with minimum of 5 years regular record of practice in swimming and out of them, 15 healthy and 15 damaged swimmers took part in this research voluntarily.

Data Collection Methodology

In conducting this research, having an age of 17 to 20, lack of feeling pain at the time of test, lack of surgery record in the shoulder in the past six months, were the standards of inclusion of the individuals of the healthy swimmers group into the research. The persons with the record of disorder in the upper organs such as difference in the length of upper organs, lack of suitable kinetic scope, surgery operation, break or dislocation or any kind of inflammatory and pain-producing disruption in the shoulder joint and neck or chest backbones, the presence of nerve and neuro-muscular system diseases, joint rheumatism and diabetics, record of consumption of hypnotic drugs, tranquilizers and muscular loosening and pain-killers drugs were removed from the research, whereas for the group afflicted with a damage, the previous record of damage in the shoulder joints in the last six months was one of the standards of inclusion. The method was in this manner that first, the examinees completed the consent forms. Then the scope of the movement of external rotation of the dominant shoulder was calculated by a standard goniometer and proprioception of dominant shoulder (sense of position and motion) by the set (inactive constant motion of physiology H.P. 2) with 1 degree preciseness and minimum speed of 1 degree in seconds. Finally, in order to describe the data, the indicators of central tendency and distribution and the descriptive static were used and in order to make an inferential analyze of data, the independent t-tests was employed using SPSS 18 software at significance level of $p \leq 0.05$.

RESULTS AND DISCUSSION

Findings

The results showed that there is a significant difference between the external rotation movement and the shoulder angle repositioning error in healthy swimmers and the similar shoulder of the damaged swimmers. However, there is no significant difference between the thresholds of sensing the movement of their dominant shoulders.

Table 1: Results of Independent t-Test in connection with the Shoulder Joint Proprioception

Statistical Indicator	Mean	Sd	df	T value	P value
Shoulder external rotation range in the healthy group	94.66	9.76	28	1.86	0.035
Shoulder external rotation range in the damaged group	86.29	9.79			
Angle reposition error in the healthy group	3	1.76	28	2.04	0.017
Angle reposition error in the healthy group	6	2.78			
Threshold of grasping the motion in the healthy group	0.33	0.48	24	0.852	0.392
Threshold of grasping the motion in the damaged group	0.53	0.74			

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Discussion and Conclusion

Reviewing the research literature showed that neither inside nor outside the country, there is a research dealing with the proprioception of shoulder joint in healthy and injured swimmers, so that in studying the research findings, those findings which were related to the proprioception in one way or another were dealt with. In this line, the findings of the present research showed that there is a significant relation between the shoulder external rotation range in the healthy swimmers and the similar shoulder in damaged swimmers. Also, there is a significant relation between the sense of shoulder joint position in healthy swimmers and the injured swimmers. It was such that the position sense of shoulder in healthy swimmers was more precise than damaged swimmers, since they had a less angle reposition error. However no significant difference was observed in the sense of motion between the two groups, though the mean of the threshold of motion sense in the healthy swimmer was lower than those of damaged group.

This finding is in accordance with the research results of Nodehi *et al.*, (1388) and is countercurrent with the research results of Wilkie *et al.*, (2002) and Safran (2001). In this connection, Wilk *et al.*, (2002) studied the ability of proprioception in 120 professional baseball players and saw no significant difference between the throwing shoulder and non-throwing shoulder. Also these individuals, in comparing the ability of proprioception of 60 baseball professional players and 60 non-throwing sportspeople, saw no significant difference between baseball players and others (Wilk *et al.*, 2003). Of course, the baseball players showed to some extent an increasing ability of proprioception at the end of the shoulder external rotation range as compared with non-throwing sportspeople, but this difference was not significant (Wilk *et al.*, 2003). Safran (2001), in studying the external rotation motion sense, with the start of the job from the angle of 75 percent of maximum external rotation saw no difference between the dominant and non-dominant shoulders of sportsmen/sportswomen.

Nodehi *et al.*, (2009) dealt with comparing the proprioception of female volleyball players' shoulder and non-sports women. The results showed that there was a significance increase in the volleyball players' external rotation range and a significant reduction in their angle reposition error as compared with non-sports people, whereas no significant difference was observed in the threshold of grasping the motion between the two groups. Zazulak *et al.*, (2007), as a result of research on healthy and injured sportswomen stated that the sportswomen who are facing with the reduction of proprioception in the joints of body and lower organs, are exposed to damage more than other sportspeople. Haber *et al.*, (2006), as a result of research on sportspeople with damages in different parts of the body, reported the reduction of proprioception in the individuals after the damage in shoulder, knee, and ankle and also in degenerative disease such as arthritis and joint rheumatism. The results of this research is in agreement with the views of researchers who put forth that as the shoulder of throwing sportspeople and sportspeople like swimmers is thinner and more calculated than non-sportspeople and damaged people and their shoulder is frequently exposed to grave rotational motions, this it leads to muscular nerve agreement and thus it causes the improvement of proprioception (Safran, 2001). Also, the distinguishing feature of this research and the studies with conflicting results is that in this study, comparison has been made on the sense of position and motion in both groups of healthy and injured (damaged) sportspeople. In fact the sportspeople's shoulder (which in all examinees was the right healthy side and with the right damaged and healthy left with the damaged left side) have been compared. Whereas, in most of the previous reaches, comparison has been made between the damaged and healthy side or two different groups of sportspeople have been compared with each other. In fact as the swimmers do not only use their dominant arm during sport performance, and use both hands, so the non-dominant organ can be under the effect of exercises. So, the results of this comparison might be distorted (Allegrucci *et al.*, 1995). Also Barnes *et al.*, (2001), in studying the impact of age, gender and dominant organ on the shoulder motion range concluded that the difference between the shoulder rotational range in two sides of dominant and weaker is to the extent that the comparison between these two sides can be misleading. The aware proprioception for the suitable performance of joints in sports, daily life activities and specialized works is necessary. The non-aware proprioception coordinates the performance of muscles and provides the

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reflexive stability (Riemann *et al.*, 2002). Finally, it can be stated that in swimming, in particular at professional level, it is necessary for the swimmer to expose his/her shoulder to rotational and frequent motions and this leads to the neuromuscular education and neuromuscular exercise will lead to the improvement of proprioception (Safran 2001). Usually, repetition can bring about learning. Perceptive learning means the increase of capacity of sensual distinguishing feature as a result of exercise, which is observed in sensual modalities such as vision, hearing and touching vibration. Perceptive learning can lead to the improvement of signal processing in a familiar position and thus will lead to the increase of preciseness of position sense (John *et al.*, 2001). In this research, as the damaged groups were far from exercises, so that the result of this research is logic.

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