The Effect of Chronic Inflammation of Rotator Cuff on Shoulder Proprioception

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ABSTRACT

The purpose of this study was to investigate the effect of chronic inflammation of rotator cuff on shoulder proprioception and to identify the relation between shoulder pain and proprioception. Forty subjects (26 males and 14 females) suffering from unilateral chronic rotator cuff tendinitis participated in this study. The uninvolved shoulder was used as a control for testing. Subjects were evaluated for shoulder proprioception by using active reproduction tests (Active Reproduction of Passive Positioning Test and Active Reproduction of Active Positioning Test) and for shoulder pain by using visual analog scale (VAS). The results of this study showed significant differences between involved and uninvolved shoulder in proprioceptive ability and poor correlation was identified between pain and shoulder proprioceptive deficit. It was concluded that proprioceptive training was recommended in case of chronic rotator cuff tendinitis.
Key words: Shoulder proprioception, pain, chronic rotator cuff tendinitis.

INTRODUCTION

Placement of the hand is a necessary task during activities of daily living and sport-specific patterns. The kinesthetic acuity in the shoulder is critical for this placement. The shoulder joint position sensibility has played a role in the maintenance of dynamic shoulder stability and has been shown to demonstrate alternation after injuries[15].

The subtle changes in the shoulder sensory system, specifically deficits in shoulder joint and muscle kinesthetic sensibility may predispose the glenohumeral joint to instability such as a loosed shoulder or a recurrent sublaxation and therefore to reinjury [11]. This gives information about the important role of shoulder proprioception in upper extremity function and shoulder joint stability.

Rotator cuff injury is one of the most common shoulder disorders which occur because of mechanical abrasion within the glenohumeral joint, the most common cause in active young adult is excessive anterior translation of the humeral head [3]. Chronic rotator cuff tendinitis is common in age between 30-50 years old and it is characterized by recurrent attacks of shoulder pain due to inflammation of tendons of rotator cuff muscles[2]. Inflammation and swelling of the tendon sheath in patient with tendinitis could distort the accuracy of stretch information from tendon. So patients suffering from tendinitis may complain from inaccuracy of dynamic position sense, so carefully assessment of kinesthesia must be addressed

when dealing with patient of repetitive strain injury[4].

The aim of this study was to determine the effect of chronic rotator cuff tendinitis on shoulder proprioception and to identify the relation between pain and shoulder proprioception.

MATERIAL AND METHODS

The study was done to evaluate the effect of chronic rotator cuff tendinitis on shoulder proprioception. The dependent variables were active reproduction of active positioning test and active reproduction of passive positioning test. The independent variable was chronic rotator cuff tendinitis. A correlation was performed to identify the relation between shoulder pain and proprioception. The shoulder pain was evaluated by using visual analog scale and correlated to shoulder proprioception of involved limb.

Sample

Forty subjects (26 males and 14 females) with age ranged between 30-50 years old, suffering from unilateral rotator cuff tendinitis were randomly recruited from Kasr El-Ani hospital and physical therapy clinic. A single group pre-post test own control design was applied. The uninvolved shoulder was assessed to establish base line for testing of involved one.

Material and equipment

1- The Akron rehabilitation system (isokinetic dynamometer) (Huntleigh Akron limited).
2- OB Goniometer "Myrin".
3- Visual analog scale (VAS).
4- Hand held stopwatch.

Procedures

1- The sample of the study was randomly selected from the referred patients.
2- A complete explanation about the procedures was given to each patient and the test procedures started by sound shoulder.
3- Every participant was subjected to a complete evaluation of the following:

A- Visual analog scale (VAS)

Participant was instructed to mark along a 10 cm horizontal line the point which reflected the degree of pain felt. The range was from no pain to unbearable pain.

B- Active reproduction tests

From sitting position, the subject was blindfolded and the OB goniometer was fastened just proximal to his elbow, the arm was positioned at 90 degrees abduction.

A narrow padded strap was securely fastened around the tested forearm to stabilize the upper extremity to the Akron system.

i. The shoulder was passively positioned at the reference angle (75 degrees shoulder external rotation) and held for 10 seconds then it was passively returned to the neutral position. After that the subject was instructed to actively reposition his shoulder at the reference angle. The procedure was repeated until three trials were recorded. The angular error was calculated by taking the difference between each trial and the reference angle then the mean of angular errors was calculated. This test was termed as active reproduction of passive positioning (ARPP).
ii. The shoulder was actively positioned at a reference angle (75 degrees of shoulder external rotation) and held for 10 seconds then it was passively returned to the neutral position. After that the subject was instructed to actively reposition his shoulder at the reference angle. The

procedure was repeated until three trials were recorded. The angular error was calculated by taking the difference between each trial and the reference angle then the mean of angular errors was calculated. This test was termed as active reproduction of active positioning (ARAP).

Data analysis

The data was analyzed to ascertain if there was any significant differences between involved and uninvolved shoulder. The paired t-test was used for comparative analysis between involved and uninvolved shoulder proprioception scores. Correlation coefficient was calculated to identify the relation between shoulder pain and proprioception.

RESULTS

Table (1) showed the minimum, maximum, mean, standard deviation and paired t-test for angular errors of (ARPP) of involved and uninvolved shoulder joints. Statistical analysis by using paired t-test showed significant differences ($P < 0.05$) between the involved and uninvolved shoulder for angular errors of (ARPP (Figure 1).

Table (1): Comparison between involved and uninvolved shoulder joints in (ARPP).

Limb	Min.	Max.	Mean	S.D	T-value	2- tail probability
Involved shoulder	5.33	10	7.544	1.594	13.66	0.000*
Uninvolved shoulder	2	6.66	3.727	1.361		

Min. = Minimum S.D= Standard deviation
Max.= Maximum * Significant ($P < 0.05$)

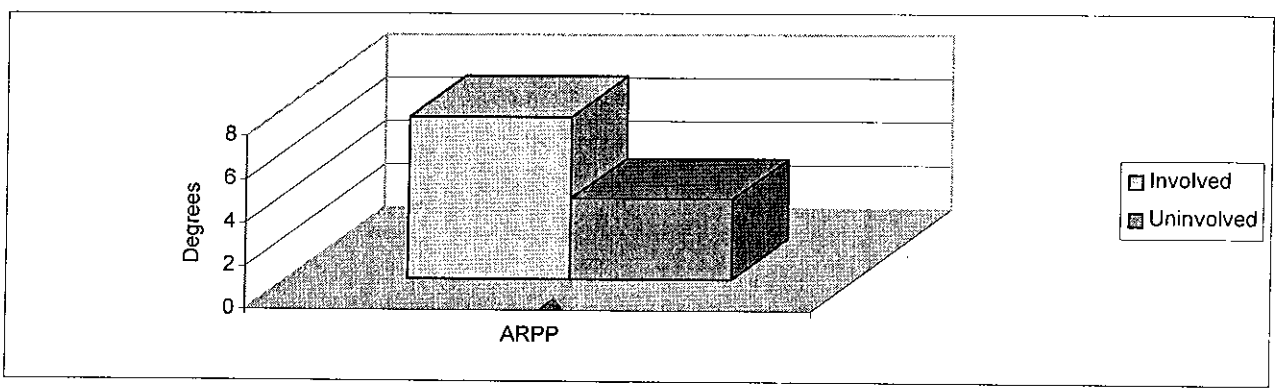

Fig. (1): The mean values of ARPP of involved and uninvolved shoulder joints.

Table (2) showed the minimum, maximum, mean, standard deviation and paired t-test for angular errors of (ARAP) of involved and uninvolved shoulder joints. The paired t-test showed significant differences ($P<0.05$) between the involved and uninvolved shoulder for angular errors of (ARAP) (Figure 2).

Table (2): Comparison between involved and uninvolved shoulder joints in (ARAP).

Limb	Min.	Max.	Mean	S.D	T-value	2- tail probability
Involved shoulder	5.66	9.33	7.821	1.050	16.80	0.000 *
Uninvolved shoulder	2	5.66	3.554	1.090		

Min. = Minimum S.D= Standard deviation
Max.= Maximum * Significant (P < 0.05)

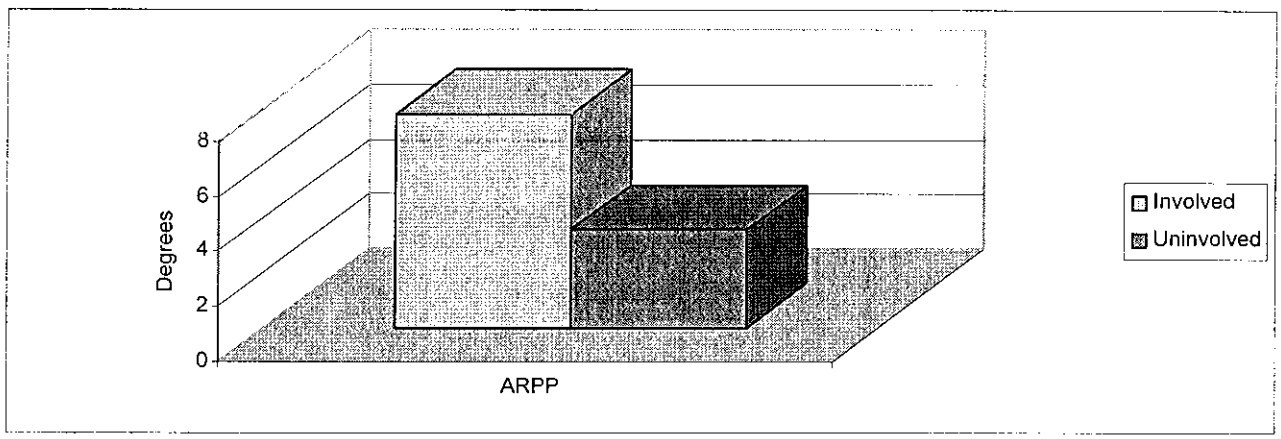

Fig. (2): The mean values of ARAP of involved and uninvolved shoulder joints.

Pain and Shoulder Proprioception

In order to identify the relation between the shoulder proprioception and shoulder pain, correlation had been examined between pain and (ARPP) of involved shoulder as shown in table (3). The results suggested that there was poor correlation between pain and ARPP (correlation co-efficient = 0.3320) (Figure 3).

Table (3): Correlation between pain and (ARPP) of invdlved shoulder joint.

Involved shoulder	Min.	Max.	Mean	S.D	Correlation co-efficient
ARPP	5.33	10	7.544	1.594	0.3320
Pain	2	8	4.65	1.776	

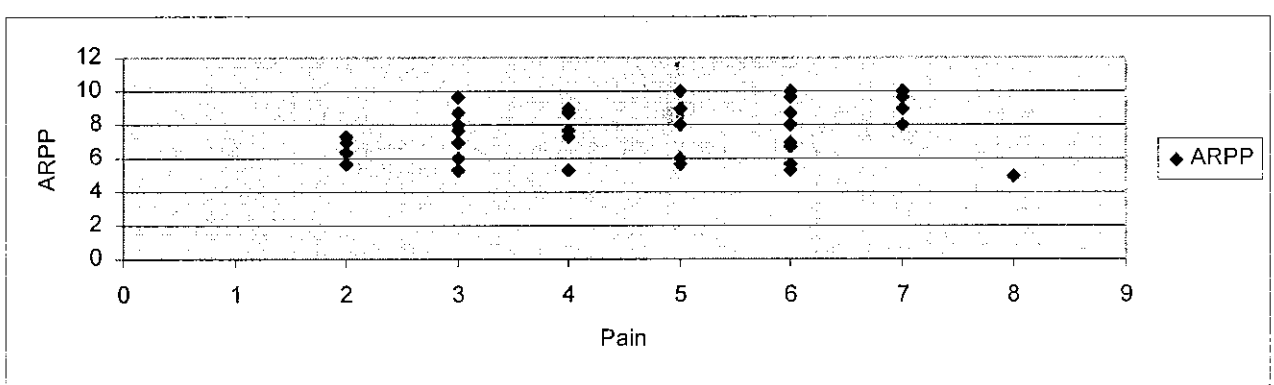

Fig. (3): Correlation between pain and ARPP of involved shoulder joint.

And there was poor correlation between pain and ARAP (correlation co-efficient = 0.3433 Table (4) (Figure 4).

Table (4): Correlation between pain and (ARAP) of involved shoulder joint.

Involved shoulder	Min.	Max.	Mean	S.D	Correlation co-efficient
ARPP	5.66	9.33	7.821	1.050	0.3433
Pain	2	8	4.65	1.776	

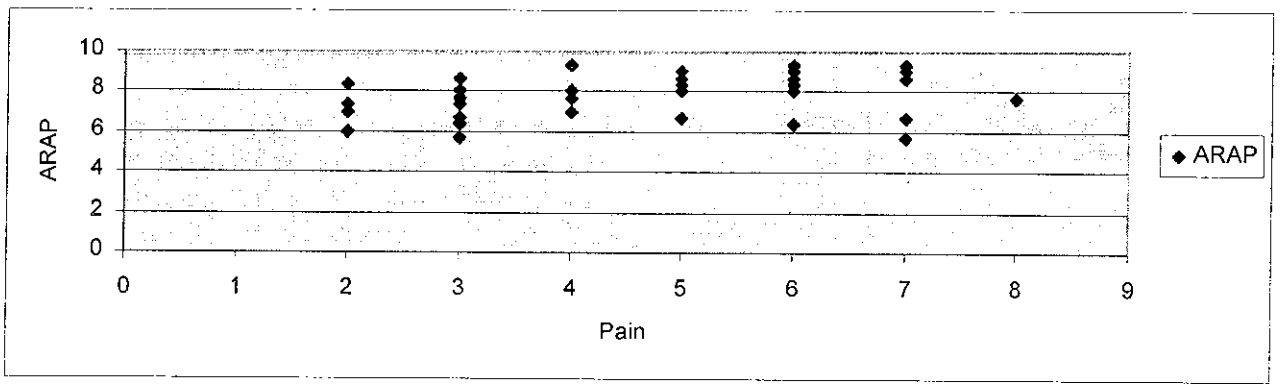

Fig. (4): Correlation between pain and ARAP of involved shoulder joint.

DISCUSSION

Chronic rotator cuff tendinitis and proprioception

The results of the present study clearly showed the effects of inflammation in the shoulder (chronic rotator cuff tendinitis) on shoulder proprioception. They revealed that shoulder proprioception was significantly affected by chronic rotator cuff tendinitis and there was a significant shoulder kinesthetic deficit. This result agreed with the finding of Byl et al.,[4] who studied the effect of a repetitive injury of tendinitis on the kinesthesia of the hand and found that subject with tendinitis performed significantly worse than controls.

The statistically significant shoulder kinesthetic deficit, which was found in chronic rotator cuff tendinitis, may be attributed to many factors. Firstly; inflammation and swelling of the tendon sheath could distort the accuracy of the stretch information from the tendon itself [4]. Secondly, the pain could reduce the proprioceptive ability[9]. Thirdly; there are large numbers of proprioceptors that received position sense and are involved in neurosensory control of glenohumeral joint stability in the rotator cuff muscles[7,11]. Damage of some musculotendinous proprioceptors could lead to inaccuracy of shoulder kinesthesia as a result of insufficient discharge or a reduced number of receptors available for discharge[6]. In case of chronic rotator cuff tendinitis, it is thought that there was damage of some rotator cuff proprioceptors. This could be another explanation of this result.

The results of the present study make a case for the importance of the role of muscle receptors. Many investigators confirmed this finding. Voight et al.,[16] suggested that muscle

receptors plays a significant role and most suited for conveying conscious awareness of joint position sense in the shoulder. Carpenter et al.,[5] agreed that muscle receptors are prominent if not primary determinant of joint kinesthesia and capsular receptors may have a secondary role. Afifi and Bergman[1] concluded that muscle receptors (muscle spindle and Golgi Tendon Organ) are primary receptors that convey position sense and joint receptors may be concerned with signaling joint movement but not position sense. Newton[12] stated that joint proprioception depend on muscle afferent for some extent and did not depend entirely on cutaneous or joint input, because joint and skin anesthesia did not alter the ability to detect joint position, and he postulated that muscle contraction would activate a pattern of joint receptors signaling joint position. In contrast to the previous, Smith and Brunolli[15] and Hoffman and Payne[8] suggested that joint receptors were responsible for kinesthesia.

Lephart et al.,[10] stated that there is a complementary relationship between muscle and joint mechanoreceptors and this relationship has been supported by the identification of the neural component necessary for the sensation of motion. This opinion is the most acceptable one.

Pain and shoulder proprioception

The results of this study showed that there was a positive weak correlation between pain and shoulder kinesthetic deficit. This result agreed with the finding of Parkhurst and Burnett[13] who found little correlation between back pain and proprioception and with finding of Gill and Callaghan[9] who concluded that differences in proprioception existed between persons with back pain and those free from back pain, so back pain reduce proprioceptive ability of the spine. In contrast to the previous opinions Revel et al.,[14] found absence of correlation between inaccuracy and pain intensity. So, proprioceptive alteration did not occurred as a result of pain.

CONCLUSION

The results of this study demonstrated that significant shoulder proprioceptive deficit occurred as a result of chronic inflammation of rotator cuff tendons. So kinesthetic rehabilitation should be considered in the treatment of patient suffering from chronic rotator cuff tendinitis. Also there was poor correlation between pain and shoulder proprioceptive deficit.

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الملخص العربي

تأثير الالتهاب المزمن لطوق العضلات المدوره لمفصل الكتف على استقبلات الكتف الحسية العميقة

الهـدف الأساسـي لهـذه الدراسة هو تحديد تأثير الالتهاب المزمن لطوق العضلات المدوره لمفصل الكتف على أستقبلات الكتف الحسـية العمـيقة وقد أجريت هذه الدراسة على أربعين مريضاً يعانون من إلتهاب مزمن بطوق العضلات المدوره لمفصل الكتف ، بدون إصابات مرضية أخرى وتتراوح أعمارهم بين ٣٠-٥٠ عاما وقد أستخدم الكتف السليم كضابط لهذا الأختبار.

وقد أستخدم فى عملية التقييم ما يلى :

١- خط تقييم الألم – لقياس شدة الألم .

٢- إختبار إعادة الوضع المسبق أو الفعال – لقياس أداء إستقبلات الكتف الحسية العميقة

وقـد أوضـحت النـتائج أن هناك خلل فى إستقبلات الكتف الحسية العميقة بالمرضى الذين يعانون من الألتهاب المزمن بطوق العضلات المدوره لمفصل الكتف كما أن هناك علاقة طردية موجبة ضعيفة بين الألم والخلل فى إستقبلات الكتف الحسية العميقة.