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RESEARCH ARTICLE

EFFECT OF LONG HEAD OF BICEPS BRACHII STRENGTH ON ACROMIOHUMERAL DISTANCE IN SHOULDER IMPINGEMENT SYNDROME PATIENTS

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ABSTRACT

Shoulder complaints are consistent with impingement in certain occupations. The biceps tendon act as a depressor of the humeral head. Excessive superior head migration contributes to reduced subacromial space. Strong positive relationship was found between the reduction of AHD narrowing and functional improvement following rehabilitation. The purpose of this study was to investigate the effect of long head of biceps (LHB) strengthening exercises in improving acromiohumeral distance (AHD) in shoulder impingement syndrome (SIS) patients. Twenty five shoulder impingement syndrome patients were recruited for this study. They were divided into two groups; biceps group (N=14, 8 males, 6 females), and non-biceps group (N=11, 6 males, 5 females). AHD was measured for all patients using ultrasonography at shoulder adduction and abduction. The results showed that there were no significant difference (P>0.06) in AHD at shoulder adduction and abduction posttest between groups. However, this difference was close to significance at abduction (*i.e.* p =0.06). These results may have future implication in improving patients pain and function.

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INTRODUCTION

The term shoulder impingement was first introduced by Neer (Neer, 1972), who described the phenomenon as a mechanical compression of the rotator cuff and subacromial bursa against the anterior undersurface of the acromion and coracoacromial ligament, particularly during elevation of the arm. In more recent literature, impingement has been described as a group of symptoms rather than a specific diagnosis (Cools, 2007a). Epidemiologic investigations have revealed a high prevalence (16%–40%) of shoulder complaints consistent with impingement in certain occupations. Frequent or sustained shoulder elevation at or above 60 degrees in any plane during occupational tasks has been identified as a risk factor for the development of shoulder tendinitis or nonspecific shoulder pain (Ludewig, 2000).

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The contraction of the biceps or the external rotators of the arm provided superior stability to the humeral head preventing superior migration (Warner, 1995; Ejnisman, 2010), by acting as superior head depressor (Hsu, 2008). On the other hand, electromyographic testing did not show muscle activity when the elbow was kept immobilized. This may implicate a more static than dynamic stabilization function of the long head of biceps (LHBT) (Levy, 2001). The biceps tendon role as a humeral head depressor and in glenohumeral stability is also highly debated (Hsu, 2008). Several authors theorize that the biceps tendon act as a depressor of the humeral head (Neer, 1972). Superior migration of the humeral head has been shown to occur when the proximal attachment of the biceps tendon is released (Kumar, 1989). There was a small association between AHD and shoulder pain and function, as well as with shoulder ROM, in patients with chronic rotator cuff related shoulder pain (San Navarro-Ledesma, 2017). In additrion to that, there is a strong positive relationship was found between the reduction of AHD narrowing and functional improvement following rehabilitation (Desmeules, 2004).

MATERIALS AND METHODS

Ethical consideration: The protocol of this study was approved by the Ethics Committee of Human Scientific Research of the Faculty of Physical Therapy at Cairo University. Subjects provided their written consents before beginning of the study after being informed about study procedures.

Subjects: 25 patients with shoulder impingement syndrome were recruited for this study from El-kasr El-Ainy hospital, Cairo University. They were divided into two groups; biceps group (N=14, 8 males, 6 females), treated with scapular and rotator cuff and biceps strengthening exercises, and stretch posterior shoulder capsule, and nonbiceps group (N=11, 6 males, 5 females) treated as biceps group but without biceps strength. The mean values of the age of patients were 31±8 and 31.5±11 in biceps group and nonbiceps group respectively. The mean values of body mass index (BMI) were 23.3±3 and 27±4 in biceps group and nonbiceps group respectively. *The inclusion criteria* were Every patient had at least 3 out of the following 6 criteria to be included in the study based on work of (Lukaseiwicz, 1999) these criteria were; 1- The patient had a positive "Neers' sign", 2-The patient had a positive "Hawkins' sign", 3- The patient had pain with active shoulder elevation in the scapular plane, 4- The patient had a history of pain in the C5-C6 dermatome, 5- The patient had pain with palpation of the rotator cuff tendons, and 6- The patient had pain with resisted isometric abduction. *Exclusion criteria were*; 1- History of shoulder instability (positive Sulcus sign, positive apprehension test history of shoulder dislocation), 2- Current history of symptoms related to cervical spine, and 3- History of acrmioclavicular pain.

Assessment

Demographic and anthropometric characteristics: Age, body weight, height of all patients were obtained. The body mass index (BMI) was calculated as follows: BMI = Body weight / height in meters squared.

Ultrasonography measurements of the acromiohumeral distance (AHD): done by placing the transducer on the lateral surface of the shoulder along the longitudinal axis of the humerus (Desmeules, 2004)

Treatment
Group (A):-treated with**:-**

Rotator cuff strengthening exercises:

The participant lay in the side-lying position with the humerus parallel to the trunk and the elbow flexed to 90. From the starting position with the forearm resting on the abdomen, he or she moved the extremity to a position of full lateral rotation 45 until the wrist joint touched the target bar (Ha, 2013).

Patient performed external rotation strengthening in standing with the addition of a small towel roll placed in the axilla, **.** In addition to assisting in the isolation of the exercise and controlling unwanted movements, this position of slight abduction has been shown to elevate muscular activity by 10% in the infraspinatus muscle when compared with identical rotational exercises performed in adduction.

Other advantages preventing decreased blood flow in the supraspinatus tendon and increasing the subacromial space (Ellenbecker, 2010).

Exercises targeted to isolate the supraspinatus such as "full can" exercise as a means to avoid the potential impingement created as the humeral head is displaced superiorly during the empty can maneuver (Escamilla, 2014).

Scapular muscles strengthening exercises

Exercises for trapezius muscle (Cools, 2007b).

- **Prone extension:** The subject is prone, with the shoulders resting in 90forward flexion. From this position the subject performs bilateral extension to neutral position, with the shoulder in neutral rotation.
- **Prone horizontal abduction with external rotation:** The subject is prone, with the shoulders resting in 90°forward flexion. From this position the subject performs bilateral horizontal abduction to horizontal position, with An additional external rotation of the shoulders at the end of the movement

Exercises for serratus anterior: (Decker, 1999)

- The standard push up plus (SPP) is a standard ush-up with the addition of full shoulder protraction (the "plus") after obtaining full elbow extension at the end of the usual push-up .
- The knee push-up plus (KPP) was performed in the same way as the SPP except that the knees are the distal point of contact with the ground rather than the feet**.**

Stretching of the posterior capsule: (Cools, 2012)

Patients lie on scapula of affected shoulder, shoulder flexed 90^o and elbow 90^0 flexion then internally rotate the shoulder maximally, hold for 30secs, repeated 4 times movement are passively performed, by the therapist, or by the patient**.**

Strength of biceps brachialis: Resisting elbow flexion with emphasis on the biceps brachii. The shoulder extends as the elbow flexes with the forearm in supination. This combined action lengthens the proximal portion of the musculotendinous unit across the shoulder while it contracts to move the elbow, thus maintaining a more optimal length-tension relationship through a greater ROM (Cools, 2014**)**.

Patients in the second group (B): received the same program without biceps strength

Statistical analysis: Shapiro-Wilk test was first done to check the normality of data distribution [25]. Then, after confirming the normal distribution of all data, unpaired t-test was used to compare the variables between the two groups. Values of *P* of less than 0.05 were considered as statistically significant. SPSS (version 20) ware was used to analyze the data.

RESULTS

As shown in table 1, there was no statistically significant difference in the measured variable between groups. The difference in AHD at abduction between the two groups is

Table 1. Subjects' demographic, anthropmetric, and clinical characteristics

Demographics and clinical data	Group A (n=14)	Group B (n=11)	P- value
Age (years), $\overline{X}$ ±SD	31(±8)	31.5(±11)	0.43
Weight (kg), $\overline{X}$ ±SD	75.6(±18.5)	78.9(±16.4)	0.4
Height (cm), $\overline{X}$ ±SD	173.8(±7.6)	167(±11)	0.041*
BMI (kg/m2), $\overline{X}$ ±SD	23.3(±3)	27(±4)	0.005*
Gender (male/female)	8/14	6/11	0.9
Dominant arm involved	7/14	5/11	0.8
Duration of illness (m), $\overline{X}$ ±SD	7.8(±6)	10.4(±8)	0.38
Duration of ttt (d), $\overline{X}$ ±SD	43(±23)	36(±8)	0.35
AHD at shoulder adduction posttest	6.41(0.96)	7.05(1.45)	0.1
AHD at shoulder abduction posttest	4.91(1.131)	4.8(1.4)	0.06

considered to be close to significance (*i.e.* *P* =0.06). Comparing the general characteristics and clinical data of both groups revealed that there was no significance difference between both groups (p > 0.05) except BMI (P=0.01).

DISCUSSION

This study was conducted to investigate the effect of long head of biceps strength exercises with regard to acromiohumeral distance at shoulder adduction and abduction in subjects suffering from shoulder impingement syndrome.. The major findings of this study were that the difference between groups was not statistically significant, however, it was somewhat close from the significance level with a *P* value of 0.060 at abduction. To our knowledge, this is the first study to investigate the effect of long head of biceps strength exercises with regard to acromiohumeral distance at shoulder adduction and abduction in subjects suffering from shoulder impingement syndrome. Acromiohumeral distance at shoulder abduction was larger in the group that performed biceps brachii strength than non-biceps group. It appears that improving the strength of long head of biceps brachii increases the acromiohumeral distance. This finding may have future implication in improving shoulder pain and function due to the strong correlation between them as reported in literature (Desmeules, 2004). Findings of the present study regarding non-significant effect of biceps strength on AHD may be due to improved ER isometric strength, this correlation was reported by White et al. (2011), who found that The AHD was not affected by resistive isometric internal rotation of the shoulder, although it decreased with resistive isometric external rotation at 45 degrees of shoulder abduction. Also, it agrees with Leong et al. (13;14) who found that AHD was related (*r* = 0.62) to the shoulder external rotation isokinetic strengths (Leong, 2016) and found that decreased strength of middle and lower trapezius was related to reduction of the SAS (Leong et al., 2012). In conclusion, Long head of biceps strengthening exercise increases the acromiohumeral distance at abduction in biceps group compared with nonbiceps group, but close to significance (P=0.06). These results might be taken into considerations in future rehabilitation of shoulder impingement syndrome.

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