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Research Article

The effects of posterior gliding of shoulder joint on shoulder joint range of motion in normal adults

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Abstract

Background/Objectives: The purpose of this study is to determine its effectiveness of posterior gliding of the shoulder joint on the shoulder joint range of motion (ROM) in normal adults.

Methods/Statistical analysis: We randomly selected 40 healthy males and females in their early to mid-20s. Of those, 20 were devided to the experimental group and the other 20 to the control group. Posterior gliding mobilization was performed between five and six times on the experimental group and a goniometer was used to measure shoulder flexion (FLE), abduction (AB), external rotation (ER) and internal rotation (IR) ROM. We also used a ruler to measure the distance between the acromioclavicular joint and the wall behind the participants before and after the experiment.

Findings: We compared the figures of the experimental group and the control group before and after the experiment. We found that there was a statistically significant change in the shoulder ROM and the distance between the acromioclavicular joint and the wall.

Improvements/Applications: The researcher hopes that posterior gliding of the shoulder joint will be utilized for patients who need improved shoulder ROM.

Keywords: posterior gliding, humeral head, shoulder joint, range of motion, mobilization, distance

1. Introduction

Shoulder joints, which have higher mobility than other joints in the human body, are flexible but unstable; their excessive movements are apartments to cause damage in bones, muscles, tendons, ligaments, and bursas[1]. Since shoulder joints are frequently used due to development in computers and smartphones, the functions and stability of the joints have become essential in daily life[2]. Inappropriate movements in terms of the positions and motions of the joints caused by unfavorable habits, lack of exercise, and incorrect posture can induce motor disturbance in the joints, altering the muscles that contribute to stabilization of and limiting movements of the joints[3]. Excessive use of the shoulder joints can impose stress on the articular capsules, inducing instability of the joints[4].

With inappropriate motions of the shoulder joints tightening the articular capsules, anterior-inferior capsular length insufficiency, in particular, can cause shoulder pain, impingement syndrome, and adhesive capsulitis. The lengthened capsules are known to be recovered by a manual therapy[5]. Kaltenborn, when designing an arthrokinematic approach from the concave-convex rule as a method of treating joint motions, reported that the mobility of movable joints could be improved by gliding toward the gliding direction of the limited joints[6]. In addition, the Mulligan technique has been proven to be significantly effective in reducing pain and increasing joint range when mobilization with exercise of the active range of motion as a therapeutic approach is applied to the limited joints[7].

It was revealed in a literature review that methods of increasing range of motion (ROM) of the shoulder joints include arthroscopic capsular release as a surgical operation and orthopedic manual therapy as a physical therapy intervention. Arthroscopic capsular release is a procedure in which an arthroscope is inserted to identify internal structures and the anterior articular capsules are incised[8], while orthopedic manual therapy relaxes the capsules manually, without using drugs or medical devices[9]. In addition, massage is effective in increasing ROM and relieving pain by preventing adhesion of muscles and tendons or ligaments and bones and removing impurities because it can reduce pain, enhance muscular strength and endurance, contribute to maintaining correct posture, and promote the supply of oxygen and nutrition and body fluid metabolism within the muscles to accelerate the circulation of blood and lymph[10-11]. Joint mobilization, one of the techniques of orthopedic manual therapy, aims to restore intra-articular movements and normal rolling and gliding, which are prerequisites for normal, painless joints[12].

It is important to eliminate anterior-inferior capsular length insufficiency in increasing ROM of the shoulder joints, but anterior-inferior capsule release through a surgical operation raises problems in terms of cost and surgical aftereffect. In this context, in this study we consistently applied shoulder joint posterior gliding, as a manual therapy to release anterior-inferior capsules, for about seven seconds to determine whether the gliding increased ROM of the shoulder joints.

2. Materials and Methods

The subjects of this study were 40 male and female students in their 20s who were at university in Korea between May 9 and July 27, 2020; half of them were randomly devided to the experimental group (10 males and 10 females) and the remaining 20 were devided to the control group (10 males and 10 females). The experimental group underwent shoulder joint posterior gliding, while the control group performed their normal daily routines. Before the experiment, the subjects understood the overall content of the experiment and voluntarily consented to participate.

2.1. Methods

2.1.1. Posterior gliding in a supine position

As shown in Figure 1, a subject was carried out in a supine position, and the therapist held a stand on the subject's head, a therapist was situated toward the head of the subject, who was in a supine posture, with one hand placed on one of the subject’s humeral heads and the other one slightly fix the opposite shoulder to prevent its lifting. To enable the humeral head to posteriorly glide against the glenoid cavity of the scapula, the therapist gently applied pressure using their weight for about seven seconds and repeated this five to six times.

Figure 1. posterior gliding on supine position

2.1.2. Posterior gliding in a sitting position

As shown in Figure 2, a therapist sat on the subject's intervention side, and the subject sat straight up on a knee-high chair with their arms hanging by their sides. The therapist palpated the subject's scapula and humeral head, pushing the scapula horizontally from the posterior to the anterior direction and the humeral head from the anterior to the posterior direction against the joint facet. The therapist softly performed the pushing first, gently pressed at the end range of the joint, and maintained the pressure for about seven seconds, repeating the process five or six times.

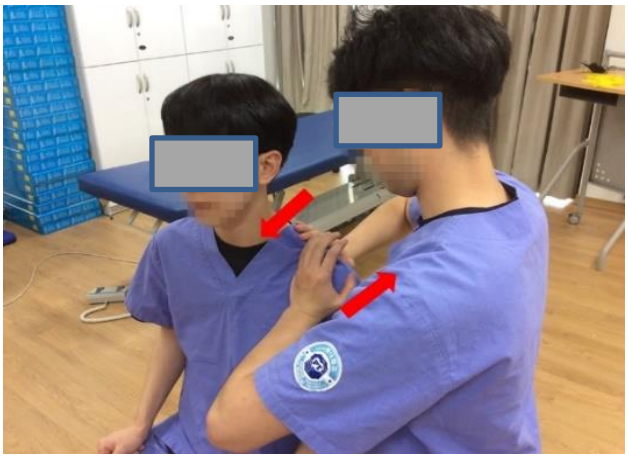

Figure 2. posterior gliding on sitting position

2.2. Measurements

2.2.1. Distance between the acromioclavicular joint and the wall (ACD)

The distance between the acromioclavicular joint and the wall was measured with a tape measure. When the subject stood straight against the wall, an investigator palpated the joint formed by the collarbone and the acromion, marked the point with a pen, and measured the horizontal distance between the acromioclavicular joint (the point) and the wall.

2.2.2. Measurement of shoulder flexion ROM

The angle of the shoulder flexion was measured with a goniometer (Patterson Medical, China), with reference to the trunk and the humerus of the subject. In measuring the angle of the shoulder flexion, the subject stood straight against the wall and an investigator was situated at the side of the subject, toward the arm to be measured. The investigator held the distal humerus with their hand and the other hand placed on the subject's shoulder joint. Bending the shoulder joint and observing whether compensation of the trunk occurred, the investigator bent the subject's arm until compensation occurred or to the end of the ROM of the joint. Lastly, after the subject's arm was fixed, the investigator measured the angle by placing the goniometer on the gleno-humeral joint with reference to the trunk and the humerus.

2.2.3. Measurement of shoulder abduction ROM

In measuring the angle of the shoulder abduction, the subject stood straight against a wall with all their fingers outstretched. An investigator, in front of the shoulder to be measured, held the lower end of the subject's radius with one hand and the other hand put on the shoulder on the same side. Abducting the shoulder joint, the investigator observed whether the elbow joint was bent or the head tilted and abducted the arm until such bending or tilting occurred or to the end of the ROM of the joint. Lastly, after the subject's arm was fixed, the investigator measured the angle by placing the goniometer on the gleno-humeral joint with reference to the trunk and the humerus.

2.2.4. Measurement of shoulder external rotation ROM

In measuring the shoulder external rotation, while the subject sat on a chair, an investigator was situated at the side of

the arm to be measured, attaching the upper arm to the trunk and bending the elbow joint by 90 degrees. The investigator fixed the subject's elbow with one hand and held the distal radius lightly with the other hand. After conducting external rotation and fixing the upper arm, the investigator measured the angle by placing the goniometer on the elbow joint with reference to the sagittal plane and the ulna.

2.2.5. Measurement of shoulder internal rotation ROM

In measuring the shoulder internal rotation, while the subject was supine on a bed, an investigator was situated at the side of the arm to be measured. After abducting the gleno-humeral joint by 90 degrees and bending the elbow joint by 90 degrees, the investigator fixed the elbow to be measured with one hand and held the distal radius lightly with the other hand. Rotating the upper arm internally, the investigator observed whether the humeral head lifted from the bed and internally rotated the arm until such lifting occurred or to the end of the ROM of the joint. Lastly, after the subject's arm was fixed, the investigator measured the angle by placing the goniometer on the elbow joint with reference to the vertical axis to the bed and the ulna.

2.3. Data analysis

The SPSS 18.0 KO (SPSS, Chicago, IL, USA) statistical program was used to analyze the measurements. The collected data were provided with means and standard deviation. A paired t-test was used to confirm significance before and after the experiment on each group. The significance level α was set at 0.05. An independent t-test was used to verify significance in the differences between the two groups.

3. Results and Discussion

As seen in Table 1, a chi-square test was used to analyze sex, and an age, height, and weight were analyzed using an independent t-test. No statistically significant differences were found in the above analyses ($p > 0.05$).

Table 1. General characteristics of subject

Group	Age	Height(cm)	Weight(kg)	Sex
Training Group (n=20)	22.33±1.19	168.23±6.01	65.35±5.74	M=10, F=10
Control group(n=20)	21.36±0.15	166.62±4.35	64.35±6.24	M=10, F=10

* $p<0.05$, M=male, F=female

When comparing the measured values of the two groups before and after the experiment, the experimental group showed statistical significance in ACD, FLE, AB, ER, and IR as shown in Table 2.

Table 2. Comparison of ACD, FLE, AB, ER and IR between Pre- and post-test in each group(mean±SD) (unit: ACD-㎜, FLE, AB, ER, IR-degree)

Category	Group	Pre-test	Post-test	t-value	p
ACD	Experimental G	112.35±12.80	96.10±12.16	10.12	.00*
	Control G	110.75±15.56	106.10±28.39	0.73	.46

FLE	Experimental G	145.25±29.26	158.25±25.35	-3.31	.00*
	Control G	138.70±15.56	139.60±24.69	-0.15	.88
AB	Experimental G	97.85±26.63	118.6±24.29	-7.99	.00*
	Control G	96.85±39.24	102.45±25.28	-0.93	.36
ER	Experimental G	55.55±8.95	65.70±12.62	-4.19	.00*
	Control G	44.95±10.95	41.80±6.58	1.35	.19
IR	Experimental G	30.10±7.69	44.60±10.30	-9.29	.00*
	Control G	34.95±9.06	33.35±9.85	1.55	.13

* p<0.05, ACD: distance between the acromioclavicular joint and the wall, FLE: flexion, AB: abduction, ER: external rotation, IR: intenal rotation

The result of comparing ACD, FLE, AB, ER, and IR values of the two groups before and after the experiment, as shown in Table 3, ER had statistical significances before the experiment ($p < 0.05$), and FLE, AB, ER, and IR had statistical significances after the experiment ($p < 0.05$).

Table 3. Comparison of ACD, FLE, AB, ER and IR between experimental group and control group (mean±SD)

	Category	Experimental G	Control G	t-value	p
Pre-test	ACD	112.35±12.80	110.75±15.56	0.35	.72
	FLE	145.25±29.26	138.70±15.56	0.71	.47
	AB	97.85±26.63	96.85±39.24	0.09	.92
	ER	55.55±8.95	44.95±10.95	3.33	.00*
	IR	30.10±7.69	34.95±9.06	-1.82	.07
Post-test	ACD	96.10±12.16	106.10±28.39	-1.44	.15
	FLE	158.25±25.35	139.60±24.69	2.35	.02*
	AB	118.6±24.29	102.45±25.28	2.00	.04*
	ER	65.70±12.62	41.80±6.58	7.50	.00*
	IR	44.60±10.30	33.35±9.85	3.52	.00*

* p<0.05

According to the use of smartphones in everyday life, resulting in unfavorable alteration of the muscular and skeletal structures and consequent structural and functional impairment of the body[13]. Instability of the shoulders indicates a lack of stability and mobility of the upper limbs and normal ROM of the shoulder joints; in addition, a habitual posture in everyday life and during working can induce a rounded shoulder posture[14].

Many previous studies have reported that surgical operation using anesthesia and various types of manual treatment could improve the ROM of patients with shoulder joint diseases. Jerosch[15] argued that 360-degree arthroscopic capsular release was effective in enhancing the ROM of the shoulder joints in terms of abduction, flexion, internal rotation, and external rotation. Holloway et al.[16] reported that arthroscopic capsular release could improve the ROM in flexion of patients with adhesive capsulitis. According to Abdelrahman & Morsi[17], arthroscopic rotator interval release could improve the ROM of patients with adhesive capsulitis in terms of flexion, external rotation,

abduction, and internal rotation.

Joint mobilization, a type of physical therapy commonly used to treat joints with low mobility, increases ROM and reduces pain[18]. A previous study compared the effects of joint mobilization with the Maitland technique and an exercise program on patients with adhesive capsulitis, reporting that the group receiving joint mobilization showed reduced pain and improved ROM[9]. Loew et al.[19] reported that the ROM of patients with primary frozen shoulders was improved by the Mulligan manual therapy technique. According to Guler-Uysal and Kozanoglu[20], the ROM of patients with adhesive capsulitis was improved by a three-times-a-week deep friction massage and mobilization for two weeks.

In this study we applied the posterior gliding technique to the humeral head of the subjects and, when the ROM of the shoulder joints was compared between the experimental and the control group before and after the experiment, the experimental group had statistical significances in ACD, FLE, AB, ER, and IR while the control group had no statistical significances in any of the items. When the values of the ACD, FLE, AB, ER, and IR of the two groups were compared before and after the experiment, ER showed statistical significances before the experiment and FLE, AB, ER, and IR showed statistical significances after the experiment. These results may indicate that, when posterior gliding of around seven seconds was repeated five to six times, changes in the distance between the two bones, as a physical element, and time, as another physical element, combined to releasing the anterior-inferior capsules, inducing reduced distance between the acromioclavicular joint and the wall and increased ROM.

The results of this study reveal that ACD, FLE, AB, ER, and IR showed statistically significant differences after the posterior gliding on the shoulder joints. We expect that the method may serve as a type of treatment for patients needing an increase in ROM.

4. Conclusion

The purpose of this study was to identify the effects of relaxation of the anterior articular capsules on the ROM of the joints of normal adults by applying posterior gliding to the shoulder joints. The subjects, 40 university students in their 20s, were randomly divided into the experimental group (n = 20; 10 males and 10 females) and the control group (n = 20; 10 males and 10 females). The control group performed their normal daily routines, while the experimental group underwent shoulder joint posterior gliding, which was maintained for around seven seconds and was repeated five to six times. The values of ACD, FLE, AB, ER, and IR in both groups were measured using a tape measure and a goniometer before and after the experiment. The results of the measurements showed that the distance between the acromioclavicular joint and the wall was reduced and the ROM was improved, indicating that shoulder joint posterior gliding was effective in improving the ROM of the shoulder joints. Further studies may be needed to develop a variety of techniques to improve shoulder joint ROM.

5. Acknowledgment

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6. References

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