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The effect of shoulder position on inferior glenohumeral mobilization

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ABSTRACT

Study Design: Cross-sectional clinical measurement study.
Introduction: Inferior mobilizations are used to treat patients with shoulder dysfunctions. Common positions recommended for promoting an inferior glide include: (1) an open-packed position (OPP) in which the shoulder is in 55° of abduction, 30° of horizontal adduction, and no rotation; (2) neutral position (NP) of the shoulder; and (3) position of 90° of shoulder abduction (ABDP). Studies comparing the impact of position on inferior mobilization are lacking.
Purpose of the Study: To determine the effect of shoulder position on humeral movement and mobilization force during inferior mobilizations.
Methods: Twenty-three subjects were tested bilaterally. Subjects were placed in the OPP, and an ultrasound transducer placed over the superior glenohumeral joint. As inferior mobilization forces were applied through a dynamometer, ultrasound images were taken at rest and during 3 grades of inferior mobilization. This process was repeated in the NP and the ABDP.
Results: In the NP, movements during grade 1, 2, and 3 mobilizations were 1.8, 3.8, and 4.5 mm, respectively. Movements measured in the OPP (1.0, 2.4, and 3.6 mm, respectively) and in the ABDP (1.0, 2.2, and 2.3 mm, respectively) were less. Forces were higher in the NP during grade 1, 2, and 3 mobilizations (51.8, 138.7, and 202.1 N, respectively) than in the OPP (37.2, 91.2, and 139.9 N, respectively) and the ABPD (42.5, 115.3, and 165.5 N, respectively).
Discussion: Mobilization position altered the movement and force during inferior mobilizations.
Conclusions: Shoulder position should be considered when utilizing inferior mobilizations.
Level of Evidence: NA.

Introduction

Joint mobilizations of the glenohumeral joint are frequently incorporated into manual therapy programs to decrease shoulder joint pain and to improve shoulder range of motion.[1] Although mobilization techniques of the shoulder can translate the humeral head in multiple directions, inferior mobilizations of the humerus are proposed as effective techniques to restore full glenohumeral abduction in individuals with restrictions in overhead movement.[2] In addition, individuals with a variety of shoulder dysfunctions have reportedly responded positively to rehabilitation programs that have incorporated inferior glides as one of the manual therapy interventions.[3-8]

Inferior glenohumeral glides, however, can be performed in multiple glenohumeral positions. Three of the most common positions for the inferior mobilization are (1) an open-packed position (OPP) of 55° of abduction and 30° of horizontal adduction; (2) neutral position (NP) with the arm at the side; and (3) abducted position (ABDP) in which the shoulder is abducted to 90°.[9] The OPP is described by Kaltenborn as being the position in which the capsule has the greatest amount of laxity and has been proposed as an optimal position for mobilization of the glenohumeral joint.[2,10] The NP is often used to assess inferior laxity of the glenohumeral joint[11] and has been incorporated into treatment plans to facilitate inferior glide in patients with impingement.[4,12,13] The ABDP reflects an increased amount of tension on the capsular ligaments of the shoulder joint, yet mobilization in an abducted range[11] has been suggested as an effective technique for increasing shoulder abduction range of motion.[4,14]

Results from a recently published study by Witt and Talbott,[15] document acceptable clinical reliability of the force and the movement associated with the OPP during 3 grades of inferior glenohumeral mobilization. During grade 1 mobilization, a movement defined as a loosening of the joint to nullify joint compressive

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forces and produce slight joint motion,[2] the intraclasss correlation coefficient (ICC) for intrasession reliability was 0.68. During grade 2 mobilization, movement that tightened joint tissues until the examiner perceived a marked resistance,[2] the ICC was 0.89, and during grade 3 mobilization, a stretching motion producing maximal movement with rapidly increasing resistance,[2] the ICC was 0.90.[15] Mean movements during grade 1, 2, and 3 inferior mobilizations in the OPP were reported as 1.0, 2.4, and 3.6 mm, and forces range from 37.4 N during grade 1 mobilization to 140.1 N during grade 3 mobilization.[15] Comparisons to other test positions and reliability of performing mobilizations in the NP and ABDP were not reported limiting the global applicability of the study's results. As clinicians incorporate manual techniques performed in different shoulder positions into treatment plans, selection of the position for the mobilization is made without a full understanding of the potential changes in movement or force that accompany the changes in shoulder position. Quantifying the variables of movement and force while mobilizing the humeral head in differing shoulder positions will help to provide the evidence needed to appropriately select the position that will maximize the desired effects of the intervention.

The purposes of this study were to (1) quantify the inferior movement of the humeral head during grade 1, 2, and 3 mobilizations in a NP and an ABDP; (2) determine the forces used during grade 1, 2, and 3 mobilizations in each of the NP and ABDP shoulder positions; (3) calculate the intratester reliability of the forces and the movements associated with grade 1, 2, and 3 mobilizations in the NP and the ABDP; and (4) compare the reliabilities, movements, and forces during the NP and ABDP with previously reported reliabilities, movements, and forces in the OPP.

Methods

Participants

This study included 23 subjects (15 female and 8 male) with a mean age of 23 years (range: 22-30) who were recruited from a population of convenience at a large urban university. This cohort was part of a larger group of individuals who participated in a multistaged study investigating glenohumeral mobilizations in various directions. Participants in this study received only inferior mobilizations. Sample size was calculated utilizing inferior translation measurements reported by Cheng et al.[16] Type I error was set at 0.05, and the power of the test was 0.80. The minimum number of participants was 22.[17]

All subjects signed an institutionally approved informed consent. Following the consent, the current and past history was reviewed using a questionnaire. Subjects were excluded from the study if they self-reported current or past history of upper extremity or neck pain, surgery or injury; current or past musculoskeletal or neuromuscular conditions; current or past history of connective tissue disorders; medically diagnosed hypermobility or hypermobility related conditions; current use of steroids; pregnancy; or the inability to speak English.

Experimental procedures

Before testing, hand dominance, height, and weight were recorded. The general hypermobility of each subject was also assessed using the Beighton Mobility Scale.[18] The glenohumeral area was then exposed to permit palpation and observation of the superior and anterior aspects of the shoulder.

Test conditions

Testing was conducted in 3 positions: NP, OPP, and ABDP. In the NP test condition, the subject was positioned sitting with the arm at the side. The elbow was flexed to 90° with the forearm supported. The mobilizing therapist (therapist 1) placed a hand held dynamometer over the proximal forearm and used their opposite hand to stabilize the contralateral shoulder and trunk. The scanning therapist (therapist 2) applied ultrasound gel to the superior glenohumeral joint and placed the ultrasound transducer in the frontal plane (Fig. 1B). The transducer was adjusted until the lateral end of the acromion, and the superior aspect of the humerus were visible on the ultrasound image. A resting image was recorded. In this study, all ultrasound imaging was performed using a Biosound MyLab 25 Gold Ultrasound Imaging System (Esaote, Indianapolis, IN) with a high frequency 40 mm linear transducer. The B-mode was used for imaging with the gain adjusted for optimization of humeral and acromial structures. Pretesting calibration was performed using a phantom before the initiation of the study.

Therapist 1 then applied a grade 1 inferior mobilization force[2] through a handheld dynamometer (MicroFET2; Hoggan Health Industries, West Jordan, UT), and an ultrasound image of the position of the humeral head during that mobilization was recorded by therapist 2 (Fig. 2). A third individual silently recorded the magnitude of the force from the handheld dynamometer. The mobilizing therapist was blind to both the ultrasound image and the magnitude of the force. This procedure was repeated during the application of grade 2 and 3 mobilizations.[2] After 30 seconds of rest, the entire process of imaging at rest and during each of 3 grades of mobilization was completed a total of 3 times in the NP.

To test in the ABDP, the aforementioned procedure was repeated with the shoulder in 90° of abduction and the forearm supported (Fig. 1C). The handheld dynamometer was placed on the superior proximal humerus and the mobilizing therapist applied the 3 grades of mobilization. As previously described, ultrasound images were recorded at rest and during each grade of mobilization. Forces used during the mobilization were also recorded. The entire process was completed a total of 3 times in the ABDP.

To test in the OPP, the subject was supine with the arm 55° of abduction and 30° of horizontal adduction (Fig. 1A). The position was confirmed using a standard goniometer. Using a hand held dynamometer placed on the superior proximal humerus, therapist 1 applied grade 1, 2, and 3 mobilizations. Ultrasound images were taken at rest and during each of the grades of mobilization. Forces were again recorded by a third individual. The entire process was completed a total of 3 times in the OPP.

After the completion of testing in all 3 positions, testing was repeated on the opposite arm. The order of testing on the shoulders (dominant vs nondominant) and the order of test position (NP, OPP, and ABDP) were randomized before testing.

All mobilization techniques were completed by 1 physical therapist who had completed a fellowship in manual therapy, was certified by the American Board of Physical Therapy Specialties as an orthopedic clinical specialist and had over 25 years of clinical experience. All imaging was completed by a second physical therapist registered in musculoskeletal ultrasound by the American Registry for Diagnostic Medical Sonography with over 6 years of experience scanning the shoulder and scapular area.

Measurements of inferior glenohumeral translation

A single examiner measured each ultrasound image using ImageJ software (http://rsb.info.nih.gov/ij/docs/index.html). To determine the position of the humeral head in each image, a horizontal line was placed parallel to the superior aspect of the acromion and a second line parallel to the superior humeral head (Fig. 2). Using ImageJ, the distance between the 2 lines was