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Original Research Article

Anterior translation of humeral head in glenohumeral joint: Comparison between limb dominance and gender using ultrasonography



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ABSTRACT

Introduction: The anterior translation of humeral head (ATHH) in glenoid cavity is one of the commonly evaluated measures to diagnose glenohumeral joint (GHJ) disorders. It is not clear that limb dominance and gender affect the ATHH in glenoid cavity. An understanding on such effects is important for clinicians to evaluate shoulder disorders.

Aim: This study compares the ATHH between gender and limb dominance among healthy individuals.

Material and methods: A total of 20 participants (12 females and 8 males) with mean \pm SD of 34 ± 5.4 years of age participated in this study. All of the participants reported no shoulder pain, shoulder injury over the past two years, and had full range of shoulder movements at the time of testing. Participants with a history of shoulder surgery and those involved in any forms of overhead sports were excluded. A real-time ultrasonography was used to measure the ATHH in GHJ during a force of 80 N applied to GHJ. Independent sample t-test and paired sample t-test were used to analyze the differences in ATHH between limb dominance and gender.

Results and discussion: The mean \pm SD of ATHH was 0.16 ± 0.08 cm and 0.13 ± 0.08 cm in dominant and non-dominant shoulder, respectively. There was no statistically significant difference in ATHH ($t_{19}=1.52$, $p=.14$, 95% CI -0.01 to 0.07) between dominant and non-dominant shoulders. There was no significant difference in ATHH between male and female participants ($t_{18}=1.90$, $p=.97$, 95% CI -0.08 to 0.84).

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Conclusions: ATHH of GHJ did not differ among genders and limb dominance in healthy participants.

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1. Introduction

Shoulder stability is characterized by the proper alignment of the humerus within the glenoid fossa.²³ The proper alignment of humerus within the glenoid fossa is determined by anterior translation of humeral head (ATHH) within the glenoid fossa.²³ In glenohumeral joint (GHJ), ATHH refers to the displacement of the humeral head (HH) relative to the glenoid due to an applied stress by the examiner.^{18,22} Hawkins et al. proposed translation as a parallel movement of a particular object due to applied stress with reference to another fixed object.¹⁸ An understanding of the direction of HH translation during an applied stress provides the clinician information regarding the direction and magnitude of the laxity at GHJ.

Palpation of HH position in relation to glenoid fossa during rest and functional activity is frequently done by the clinicians as part of shoulder evaluation.⁹ It is believed that altered translation of HH in relation to glenoid fossa is one of the causes for shoulder problems.⁹ Thus, the knowledge on the HH especially ATHH in glenoid becomes a variable of interest to clinicians. In practice, quantifying the direction and magnitude of the HH translation at GHJ aids practitioners towards decisions on surgery or rehabilitation for shoulder problems. However, it is not clear whether the ATHH differs between dominant and non-dominant extremities. It is also unknown whether a gender difference exists in ATHH when clinicians interpret the translation measurements in clinical practice of shoulder conditions. Therefore it is important to investigate whether the range of motion of ATHH differs between genders, dominant and non-dominant GHJ.

Limb dominance or handedness is one of the factors reported to affect the range of motion of the upper extremity.^{3,4,11,15} It is defined as the ability of the individual to use one hand predominantly than the other hand during uni-manual functional tasks.^{3,4,17} Past studies had compared several clinical variables related to shoulder joint such as radiological shoulder balance,² range of motion,⁵ rotational strength,¹⁷ proprioception^{1,30} and kinematic analysis of scapulohumeral-shoulder muscles,³³ between dominant and non-dominant arms in order to find out the effect of limb dominance. Other studies reported differences in the range of motion of active and passive movements in the internal and external rotation movements in the dominant shoulder in comparison to the non-dominant shoulder.^{3,4,15} The dominant hand was suggested to produce more force than the non-dominant hand.²⁴ According to the 10% rule on limb dominance, it was suggested that the maximum strength was 10% higher in dominant hand than the non-dominant hand.²⁵ The above studies imply that limb dominance is one of the crucial factors that might influence the clinical outcome of the shoulder joint examination.

Gender is also another factor that may affect the ATHH in GHJ. Women seem to have smaller anthropometric dimensions compared to men.³¹ It is reported that females have increased thoracic curve and greater cervical joint range of motion when compared to males.¹⁰ A recent study on the MR imaging of the GHJ between genders reported higher size, height and weight of HH among men when compared to women.²⁷ Gender differences were also identified in the biomechanical data for the hip, knee and ankle, with females having greater hip flexion, anterior pelvic tilt and lesser knee extension.^{8,20} It raises the scientific quest to inquire whether gender differences exist in the ATHH in GHJ. Therefore, the main aim of this study was to report on the differences in the ATHH of the GHJ between the genders and limb dominance among healthy participants. This study hypothesizes that ATHH does not differ between limb dominance and gender. This study was performed to develop an understanding on the effects of gender and limb dominance on ATHH in GHJ.

2. Aim

The aims of the study were (1) to investigate any difference in ATHH in glenoid cavity between the dominant and non-dominant shoulder joints among healthy participants and (2) to compare ATHH in glenoid cavity between male and female participants with healthy shoulder joints.

3. Material and methods

3.1. Subjects

A total of 20 healthy participants (12 females and 8 males) participated in this study. The participants were recruited among the patient care givers who accompanied other patients to the hospital and as well as the staff from the hospital who volunteered to participate in the study. All the participants were selected based on pre-defined study criteria. In general, all the participants had full range of shoulder motions with no history of any symptoms in shoulder joint. Any participants with pregnancy, shoulder pathology, presence of pain on the shoulder or any shoulder injuries over the past 3 months, with any past history of shoulder surgery and participants more than 60 years of age were excluded. Participants who were involved in repetitive activities for the shoulder joints such as overhead sports were also excluded. The subjects were briefed about the study details and a written informed consent was obtained prior to their participation in the study. The ethical approval for this study was obtained from a University Hospital Ethical Committee with ethical code NN-181-2011.

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