



Comparison of shoulder internal rotation passive range of motion in various positions in nonathletic persons and the establishment of normative values for the sidelying position

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Background: Loss of shoulder internal rotation (IR) range of motion (ROM) is prevalent in overhead athletes, but it can also be seen in nonathletic persons. A paucity of normative data exists, however, for shoulder IR ROM in positions other than supine, especially in nonathletic persons. The aim of this study was to determine shoulder IR ROM differences between the sidelying, semi-sidelying, and supine positions as well as to establish initial normative values for IR ROM for the sidelying and semi-sidelying positions in nonathletic persons.

Methods: IR ROM was measured on 204 nonathletic persons using the sidelying, semi-sidelying, and supine positions. Mean values of IR ROM for each position were calculated. Differences in IR ROM across the 3 positions and side-to-side differences were examined, including the influence of sex and age on IR ROM.

Results: Intra-rater and inter-rater reliability for the sidelying position was excellent. The sidelying position had significantly less IR ROM compared with the other positions, and there was a significant side-to-side IR ROM difference, greatest for the sidelying position (6.8°). Women had significantly more IR ROM than men did, with sidelying normative values of 49° and 55° for female dominant and nondominant shoulders, respectively, and 42° and 51° for male dominant and nondominant shoulders, respectively.

Conclusion: This investigation establishes initial normative IR ROM values for the sidelying position for both shoulders and sexes. Health care providers can begin to examine IR ROM deficits using these normative values for the sidelying position.

This study protocol was approved by the Institutional Review Board of St. Catherine University (IRB#13-EXP-06). Informed consent was obtained from each participant before participation in the study, and the rights of participants were protected.

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Shoulder dysfunction that limits activity is not uncommon among the general population. For example, it has been stated that at a given time, >15% of the general population has shoulder pain and other restrictions that can lead to decreased function and decreased quality of life.^{9,32} Furthermore, in women aged 35 to 74 years, the most common musculoskeletal reason to seek medical care was shoulder and neck pain.⁹ One of the most common limitations accompanying shoulder dysfunction is a loss of internal rotation (IR) range of motion (ROM). The loss of IR ROM has been studied extensively in overhead athletes.^{12,13,17,18,22,24,30} In comparison, there is a paucity of literature investigating IR ROM in nonathletic persons, yet a difference in IR ROM between the dominant and nondominant shoulders has been demonstrated, with the dominant shoulder having less motion.^{6,11,16,36} Based on this side-to-side difference, previous research has not supported using the IR ROM value of the contralateral shoulder in examining motion loss of the involved shoulder,^{2,11,36} thus highlighting the need to establish normative shoulder IR ROM values for both the dominant and nondominant shoulders in nonathletic persons.

The current standard for measuring shoulder IR ROM uses the supine position with the arm abducted to 90°.^{10,12,17,25,27,28,31} Authors have noted, however, a lack of consistent stabilization of the scapula, and thus inconsistent end-feels may be present when the supine position is used to assess the glenohumeral joint contribution to shoulder IR ROM.^{8,13,21,24,29} These issues have been implicated in lower intra-rater^{10,21} and inter-rater reliability^{10,21,29} obtained for the supine IR ROM position.

Researchers have recently examined the sidelying position as an alternative option for measuring IR ROM.^{9,10,19,21} In studies of nonathletic persons,⁹ overhead athletes,^{10,19} and subjects with shoulder disease,²¹ greater intra-rater and inter-rater reliability has been reported when shoulder IR ROM is assessed with a sidelying position. It has also been purported that the sidelying position allows the scapula to be stabilized by the individual's own body weight^{10,19,21}; thus, IR ROM measurements taken in this position are likely not to be influenced by variations in stabilization force provided by the examiner. Also, in contrast to the supine position, the sidelying position may limit scapular anterior tilting that occurs during IR, leading to a more distinct capsular end-feel and likely isolating IR ROM to the glenohumeral joint.^{10,19,21}

The semi-sidelying position, akin to the modified sleeper stretch position, is a position halfway in between supine and sidelying, and it has been used along with the sidelying position as an intervention to address IR ROM deficits. There

is a lack of research, however, regarding the reliability of the semi-sidelying position compared with the supine position in measuring IR ROM, and no previous studies have identified normative IR ROM values using this position.

As noted previously, IR ROM loss is present in individuals who are nonathletic persons, and authors have advocated not using the contralateral shoulder for IR ROM comparisons. In light of these factors, a study of nonathletic persons to compare IR ROM across various positions and the establishment of initial normative IR ROM values for the sidelying and semi-sidelying positions is warranted. The primary purposes, therefore, of this investigation of nonathletic persons were (1) to determine if there is a significant difference in shoulder IR ROM for the dominant and nondominant shoulders between the sidelying, semi-sidelying, and supine positions; (2) to establish initial normative values for passive shoulder IR ROM across the adult lifespan for the sidelying and semi-sidelying positions; (3) to quantify side-to-side differences in IR ROM for each of the 3 IR positions; and (4) to determine if sex or age significantly affects IR ROM across the 3 IR positions.

The hypotheses of this investigation were that (1) IR ROM for the dominant and nondominant shoulders is significantly different between the 3 IR positions, with the sidelying position yielding the least amount of IR ROM; (2) the dominant shoulder would have significantly less IR ROM than the nondominant shoulder for each of the IR positions; and (3) men will have significantly less IR ROM across the 3 IR positions compared with women, and IR ROM will decrease with increasing age.

Materials and methods

All testing procedures were completed in a single session lasting approximately 30 minutes, except for the reliability portion of this study, which took place during 2 testing sessions on consecutive days. A cross-sectional study design was employed to calculate mean values for sidelying, semi-sidelying, and supine IR ROM. Independent variables in the study were sex, age, and upper extremity dominance, which was defined as the arm used by the participant to throw a ball. The dependent variables were dominant and nondominant shoulder IR ROM for the 3 IR positions. Participants were recruited through a sample of convenience.

Participants

Participants were included in this study if they were (1) 18 years of age or older, (2) were symptom free in at least 1 shoulder, and

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