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## RELIABILITY OF ELECTROMAGNETIC TRACKING OF SCAPULAR ORIENTATION

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### SUMMARY

Proper scapular position and orientation relative to the thorax are necessary for normal function of shoulder complex. Reliable measurement of position and orientation is critical to be able to study the effects of shoulder pathokinesiology and clinical interventions. The objective of this study was to assess scapular rest position and analyses the intra and inter-session reliability using electromagnetic tracking. The scapular rest position is analyzed by the scapular rotations and distances between the scapula and the thoracic column. Twenty healthy and sedentary subjects aged between 18 and 40 years were recruited. The electromagnetic system 3SPACE Liberty (Polhemus Inc.) captured the habitual scapular rest position. At each assessment, the same examiner performed three collections of scapular position. To determine the inter-session reliability, the procedure was repeated after 7 to 10 days. The Intra-class Correlation Coefficient [intra-session (ICC 2,1) and inter-session (ICC 2,k)] was calculated to establish the reliability. Results were interpreted as poor when less than 0.40, good between 0.40 and 0.75 and excellent when greater than 0.75. The ICC results found varied from good and excellent to inter-session reliability and excellent to intra-session (Table 1). In agreement with the ICC values found after analyses, from this population, the electromagnetic system of data acquisition is a reliable measure to scapular rest position assessment.

### INTRODUCTION

Scapular position and orientation relative to the thorax are critical components that allow properly humeral head centralization and provide a base to the normal function

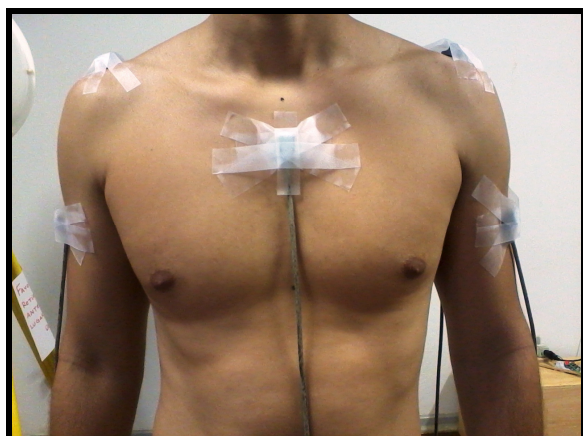
of shoulder complex during diary activities and sports [1,2]. Also, many muscles are inserting in scapula, so, the scapular position influences the length-tension relationship and this muscles efficiency [2].- According to the importance of scapula position, it's necessary a reproductive and reliable measure to assessment of this position. The electromagnetic system data acquisition provides a non-invasive assessment on three dimensions of segments position and movement [3]. However, there is no study that evaluates the reliability of the rest position through this system. The objective of this study was to assess scapular rest position in health subjects and analyses the intra and inter-session reliability of this assessment through the electromagnetic system of data acquisition.

### METHODS

The study included 20 subjects, with [mean (SD)] age of 23,15 (2,91) years, height of 1,69 m (0,07), and weight of 64,30 kg (14,46). Inclusion criteria included being sedentary, healthy and age between 18 and 40 years. The electromagnetic system 3SPACE Liberty (Polhemus Inc.) captured scapular rest position with the subject upright with the arms beside the body (Figure 1). The scapular rest position was analyzed by the scapular rotations and distances between the scapular superior and inferior angles and T3 and T7 vertebrae on the thoracic spine.

At each assessment, the same examiner performed three collections of scapular position. To determine the inter-session reliability, the procedure was repeated after 7 to 10 days. The Intra-class Correlation Coefficient [intra-session (ICC 2,1) and inter-session (ICC 2,k)] was calculated to establish the reliability. Results were

interpreted as poor when less than 0.40, good between 0.40 and 0.75 and excellent when greater than 0.75 [4].



**Figure 1.** Subject and sensors position for collect.

## RESULTS AND DISCUSSION

The results found varied from good ( $\geq 0.40$  and  $\leq 0.75$ ) and excellent ( $\geq 0.75$ ) to inter-session reliability and excellent ( $\geq 0.75$ ) to intra-session reliability to the scapular rotations and distances between the scapula and the thoracic vertebrae (Table 1). In agreement with the ICC values found after analyses, from this population, the electromagnetic system of data acquisition is a reliable measure to scapular rest position assessment.

Since it was not found in the literature any reliability study with scapula resting position assessment through electromagnetic system data acquisition is not possible to compare the values found. Reliability studies for evaluation of scapular rotation during humeral elevation in different planes with the same system found ICC values between good and excellent [3,5].

## CONCLUSIONS

The results found in this study showed that the electromagnetic system is a reliable method to scapular rest position assessment, presenting good or excellent inter-session reliability and excellent intra-session reliability.

## ACKNOWLEDGEMENTS

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**Table 1:** ICC values from inter and intra-session reliability (n=20)

	£Inter-session Reliability		¥Intra-session Reliability	
	Dominant Member	Non-dominant member	Dominant Member	Non-dominant member
<b>Medial/lateral rotation</b>	0,78	0,41	0,98	0,98
<b>Superior/inferior rotation</b>	0,90	0,75	0,98	0,98
<b>Anterior/posterior tilt</b>	0,86	0,74	0,98	0,99
<b>Distance between scapula superior angle and T3</b>	0,94	0,77	0,95	0,97
<b>Distance between scapula inferior angle and T7</b>	0,92	0,61	0,98	0,99

£ Inter-session ICC 2,k; and ¥ intra-session ICC 2,1