



Original Article

## Interrater reliability and intrarater reliability of lateral scapular slide tests of females in their 20s

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**Abstract.** [Purpose] The purpose of the present study was to examine the intrarater reliability and interrater reliability of lateral scapular slide tests among young females. [Subjects and Methods] A total of 60 female students in U University in Gyeongsangbuk-do, South Korea participated in this study. Lateral scapular slide tests (LSST) were conducted to identify interrater & intrarater reliability. In the LSSTs, the distance from the inferior angle of the scapula to thoracic vertebral spinous process T8 was measured in three positions (shoulder joint 0°, 45°, and 90° abduction) using tape measures. [Results] Intrarater reliability is shown to be moderate with scores not lower than 0.7 in left positions 1 and 3 and is shown to be excellent with scores not lower than 0.9 in the remaining positions. Interrater reliability is shown to be excellent with scores not lower than 0.9 in all three left and right positions. [Conclusion] LSST is sufficiently high to be accepted as an objective tool in the results of general previous studies. In addition, it can be considered useful at clinics because the measuring tool and method are simple.

**Key words:** Lateral scapular slide test, Asymmetry of the scapula, Reliability

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### INTRODUCTION

In the human body, the roles of the scapula are important and the scapula has a significant effect on shoulder movements because it is directly connected to the humerus<sup>1)</sup>. The scapula is the location where the muscles around the shoulder can be attached and it helps the scapula movements when the humerus moves to allow the shoulder to move more diversely<sup>2)</sup>.

These characteristics are attributable to the fact that the scapula is not fixed to the trunk through articulation between the bones but mainly through muscles, which leads to a high degree of freedom along with the high instability of the scapula<sup>3)</sup>.

When problems occur with the functions of muscles around the shoulder joints due to musculoskeletal system diseases, the scapula reverts to abnormal positions as it is highly dependent on muscles<sup>4)</sup>.

As such, the scapula's abnormal positions are closely related to musculoskeletal system diseases and studies have been conducted on methods of predicting shoulder joint disorders<sup>3-6)</sup>.

Among these methods is a representative technique that uses lateral scapular slide tests (LSST). Kibler states that the decline of muscle stability around the shoulder and shoulder joint disorders can be identified by measuring the distance between the thoracic vertebrae and the scapula<sup>1)</sup>. This method has the advantages of short measuring time and easy measurement that requires only a tape measure.

However, for this method to be recognized as objective, its interrater reliability and intrarater reliability should be high. The reliability of LSST in young females has yet to be measured. Therefore, the purpose of the present study was to examine the intrarater reliability and interrater reliability of lateral scapular slide tests among young females.

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## SUBJECTS AND METHODS

The present study was conducted with 60 female students of U University in Gyeongsangbuk-do. The mean age, mean height, and mean weight of the subjects were  $20.7 \pm 1.0$  years,  $160.8 \pm 4.9$  cm, and  $57.2 \pm 8.8$  kg, respectively. The subject selection criteria were as follows: those that had a mild pain in the neck but suffered from no diseases that could affect the study. Those that had any damage to vision or hearing, had problems in the nervous system or the vestibular organs, or were unable to understand the contents of the experiment were excluded. All subjects understood the purpose of this study and provided written informed consent prior to participation in the study in accordance with the ethical standards of the Declaration of Helsinki.

In the present study, lateral scapular slide tests (LSST) were repeatedly conducted to identify interrater & intrarater reliability. These tests were designed to measure the asymmetry of the scapula according to changes in the load on the shoulder joint by spreading the upper limbs. The tests were designed by Kibler<sup>1)</sup>. In this method, distances from the thoracic vertebral spinous process to the scapula in the left and right sides of the shoulder joints are measured to evaluate the lateral asymmetry of the scapula. This study measured the reliabilities of the measurement values in the left and right sides. In the LSSTs, the distance from the inferior angle of the scapula to thoracic vertebral spinous process No.8 was measured in three positions (shoulder joint 0°, 45°, and 90° abduction) using tape measures.

Two testers measured the lower limb muscle strength of the same subjects separately to identify interrater reliability. The LSSTs of the subjects were conducted twice at an interval of one day by the same testers to identify intrarater reliability. Before beginning the measurements, both the testers and the subjects were sufficiently familiarized with the measuring methods. All the measurements are expressed as mean  $\pm$  standard deviation.

SPSS for Windows (version 22.0) is used to analyze the data in the present study. Intraclass correlation coefficients (ICCs) are used to examine interrater reliability and intrarater reliability. The statistical significance level is set to  $\alpha=0.05$ .

## RESULTS

Intrarater reliability is shown to be moderate with scores not lower than 0.7 in left positions 1 and 3 ( $p<0.05$ ) and is shown to be excellent with scores not lower than 0.9 in the remaining positions ( $p<0.05$ ) (Table 1).

Interrater reliability is shown to be excellent with scores not lower than 0.9 in all three left and right positions ( $p<0.05$ ) (Table 2).

**Table 1.** Intra-rater reliabilities of lateral scapular slide test

Position	Side	Measurement (mm)		ICC (95% CI)
		1st	2nd	
Position 1	Left	$8.81 \pm 1.63$	$8.75 \pm 1.68$	0.730 (0.61–0.81)*
	Right	$8.50 \pm 1.45$	$8.77 \pm 1.43$	0.842 (0.77–0.89)*
Position 2	Left	$8.94 \pm 1.80$	$8.95 \pm 1.84$	0.818 (0.74–0.87)*
	Right	$8.86 \pm 1.68$	$8.90 \pm 1.55$	0.830 (0.76–0.88)*
Position 3	Left	$9.17 \pm 1.80$	$8.84 \pm 2.27$	0.722 (0.59–0.81)*
	Right	$9.03 \pm 1.78$	$9.02 \pm 2.02$	0.801 (0.71–0.86)*

Mean  $\pm$  SD, \* $p<0.05$ , ICC: intraclass correlation coefficient, CI: confidence interval, Position 1: LSST with shoulder abduction at 0 degrees, Position 2: LSST with shoulder abduction at 45 degrees, Position 3: LSST with shoulder abduction at 90 degrees

**Table 2.** Inter-rater reliabilities of lateral scapular slide test

Position	Side	Measurement (mm)		ICC (95% CI)
		Examiner 1	Examiner 2	
Position 1	Left	$8.81 \pm 1.63$	$8.71 \pm 1.49$	0.937 (0.91–0.96)*
	Right	$8.50 \pm 1.45$	$8.59 \pm 1.53$	0.929 (0.90–0.95)*
Position 2	Left	$8.94 \pm 1.80$	$9.10 \pm 1.99$	0.925 (0.89–0.95)*
	Right	$8.86 \pm 1.68$	$8.86 \pm 1.73$	0.968 (0.95–0.98)*
Position 3	Left	$9.17 \pm 1.80$	$8.87 \pm 1.84$	0.918 (0.88–0.94)*
	Right	$9.03 \pm 1.78$	$8.79 \pm 1.97$	0.920 (0.89–0.94)*

Mean  $\pm$  SD, \* $p<0.05$ , ICC: intraclass correlation coefficient, CI: confidence interval, Position 1: LSST with shoulder abduction at 0 degrees, Position 2: LSST with shoulder abduction at 45 degrees, Position 3: LSST with shoulder abduction at 90 degrees

## DISCUSSION

The present study was conducted to examine the reliability of the lateral scapular slide tests to enable predictions of musculoskeletal system diseases using scapula positions. The interrater reliability and intrarater reliability were examined in young females. The results of the present study show that the intrarater reliability is at least moderate with scores in a range of 0.72–0.84. The interrater reliability is shown to be excellent with scores not lower than 0.9 in all three left and right positions.

In the present study, interrater reliability is higher than intrarater reliability, unlike some previous studies. Gibson et al., who tested similar subjects to those tested in the present study, find that intrarater reliability is higher than interrater reliability, in contrast to the present study<sup>5)</sup>. Shadmehr et al. find that interrater reliability and intrarater reliability are similar to each other<sup>6)</sup>. However, Shadmehr et al. reveal different results from those of the present study because it was conducted with subjects of diverse age groups ranging from 18 to 65 years, unlike the young subjects used in the present study. In addition, Koslow et al. report that in LSSTs, specificity is shown to be higher among females than males, and the scores are different between genders<sup>7)</sup>. Therefore, these differences are considered attributable to the fact that the subjects of the study by Gibson et al. included both males and females, while the present study tested only young females<sup>5)</sup>. However, the fact that the intrarater reliability and interrater reliability of LSSTs are high and exceed a certain level in the present study is consistent with previous studies.

In the present study, the reliability is not much different between different positions, but some previous studies indicate that the reliability levels are different between testing positions. Odom et al. find the reliability to be higher in position 3, in which the arms are spread out more, than positions 1 and 2, which are relatively more static (4). Shadmehr et al. find that the reliability levels are not much different between different positions in the group of healthy people without shoulder disease as with the present study, but are higher in position 3, when the arms are spread out more, as with the study by Odom et al.<sup>4, 6)</sup>. It can be seen that the reliability of LSST is not much different between the static positions with the arms not spread out and the dynamic position with the arms spread out laterally among the healthy adults, but was higher in position 3 with the arms spread out among the participants that have shoulder disease.

Gibson et al. report that when LSSTs compare the dominant hand with the non-dominant hand, higher reliability is shown in the dominant hand<sup>5)</sup>. In the present study, intrarater reliability test results show relatively lower reliability for the left hand than the right hand. Given that most Koreans are right-handed, the results of the present study can be said to be consistent with the results of Gibson et al.

Although the reliability of the LSST is a little different according to the conditions of subjects, such as the age groups, whether the subjects have musculoskeletal system diseases or not, and dominant/non-dominant hands, it is sufficiently high to be accepted as an objective tool in the results of general previous studies. In addition, it can be considered useful at clinics because the measuring tool and method are simple.

A limitation of the present study is that the study subjects are young adults and do not represent all subjects. In future studies, the reliability between diverse subjects in terms of age groups, shoulder diseases, athletes and others, and genders should be analyzed.

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