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Test-retest reliability of an active range of motion test for the shoulder and hip joints by unskilled examiners using a manual goniometer

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Abstract. [Purpose] The purpose of this study was to analyze test-retest reliability of an active range of motion test using a manual goniometer by unskilled examiners. [Subjects and Methods] Active range of motion was measured in 30 students attending U university (4 males, 26 females). Range of motion during flexion and extension of the shoulder and hip joints were measured using a manual goniometer. [Results] Flexion and extension of the shoulder joint (ICC=0.906 and ICC=0.808) and (ICC=0.946 and ICC=0. 955) of the hip joint showed excellent reliabilities. [Conclusion] The active range of motion test using a manual goniometer showed very high test-retest reliability in unskilled examiners. When examiners are aware of the method of the test, an objective assessment can be conducted.
Key words: Range of motion, Reliability, Tests and measurement

INTRODUCTION

A proper assessment is as important as appropriate treatment for range of motion disorders. One of the most common assessment methods among physical therapists is measuring range of motion (ROM) of the joint using a goniometer[1, 2]. This method has been used for almost 90 years. Baseline limitation on ROM of a patient can be obtained before treatment, and changes induced in this motion after therapeutic interventions is easily determined[3].

Reliability studies on ROM measurement of the joint using goniometer have been studied in depth, and have shown high reliability. However, most of these studies were conducted by skilled physical therapists[1, 2, 4, 5].

Because it takes time for physical therapists to develop their expertise, many patients are assessed by therapists who have not yet perfected their skills. An objective tool is needed for unskilled physical therapists that indicates their awareness of use, and should show a high test-retest reliability over a period of time. If the results by unskilled therapists show high reliability through the precise understanding of the tool and its measurement method, the tool can be used more objectively. Therefore, the purpose of this study was to analyze the reliability of the active ROM test using a manual goniometer conducted by unskilled therapists.

SUBJECTS AND METHODS

This study was conducted with 30 students (4 males, 26 females) attending U university in K province. The mean age, height, and weight of the participants were 20.5±1.2 years, 167.8±7.1 cm, and 58.3±9.7 kg, respectively. The selection

Table 1. Test-retest reliabilities of range of motion measurements using goniometer

Joint		Measurement (˚)		ICC (95% CI)
		1st	2nd	
Shoulder	Flexion	147.2±16.0	152.9±14.2	0.906 (0.79–0.95)*
	Extension	50.3±12.5	51.9±13.9	0.808 (0.57–0.91)*
Hip	Flexion	107.4±12.0	107.8±11.7	0.946 (0.87–0.97)*
	Extension	23.1±7.2	24.2±8.2	0.955 (0.89–0.98)*

Mean±SD, *$p<0.05$, ICC: intraclass correlation coefficient, CI: confidence interval

criteria for the subjects were as follows: no disease affecting the results of the test and no shoulder or hip joint problems. Those who were unable to understand the nature of the study 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 standard of the Declaration of Helsinki.

A manual goniometer was used to measure active ROM of flexion and extension of the shoulder and hip joints; the most common and easily measured joints for ROM. Subjects and examiners were university students majoring in physical therapy who had little experience using a goniometer. Groups of two students measured each other's ROM on subsequent days and all were informed about the nature of the procedure before the test.

Flexion was measured in the supine position with the shoulder and hip at 0 degrees of abduction, adduction, and rotation, and extension was tested in the prone position with the shoulder and hip at 0 degrees of abduction, adduction, and rotation[6, 7]. All measurement values are reported as mean value ± standard deviation.

SPSS for Windows (version 20.0) was used to analyze data. The intra-class correlation coefficient (ICC) was used to examine the test-retest reliability. The statistical significance used was α = 0.05.

RESULTS

An ICC of 0.906 was obtained for flexion and that of 0.808 was obtained for extension of the shoulder joint, which were excellent reliabilities ($p<0.05$). Similarly, an ICC of 0.946 was obtained for flexion and that of 0.955 for extension of the hip joint, which were excellent reliabilities ($p<0.05$) (Table 1).

DISCUSSION

The ROM of shoulder and hip are the easiest and most commonly measured An ICC of 0.906 was obtained for flexion and that of 0.808 was obtained for extension of the shoulder joint. Similarly, an ICC of 0.946 was obtained for flexion and that of 0.955 was obtained for extension of the hip joint. The test-retest reliabilities of this study were excellent and not lower than those in previous studies[1, 2, 4, 5].

Particularly, the hip joint showed a higher reliability than that in a previous study. Pua et al. presented that the test by a skilled single examiner with 7 years of clinical physiotherapy experience showed high reliabilities for flexion (ICC=0.97) and extension (ICC=0.86) of the hip joint[5]. This study showed a higher ICC for extension than that in a previous study. The fact that unskilled examiners showed a higher reliability proves that ROM can be used to assess joints.

Both shoulder and hip joints showed high reliabilities, but the reliability of the shoulder joint was lower than that of the hip joint. Gajdosik & Bohannon reported that the test-retest reliability for simple joints is higher than that for multiple joints and the movement of joints is affected by multiple joints and numerous muscles crossing these joints[3]. The shoulder joint has better mobility but its stability is highly affected by the surrounding muscles because it has a flat articular surface and may be the reason that the shoulder joint had lower reliability than the hip joint. However, there is no doubt that the reliabilities of both joints were excellent.

In conclusion, an active ROM test using a manual goniometer even by unskilled examiners showed very high test-retest reliability. When examiners are aware of the method of the test, an objective assessment can be conducted. A limitation of this study was that the measurement was performed only for the shoulder and hip joints, and other joints should be assessed in future studies.

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