



Cross-cultural adaptation, validity and reliability of the Korean version of the Kerlan-Jobe Orthopedic Clinic shoulder and elbow score

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Background: The Kerlan-Jobe Orthopedic Clinic shoulder and elbow score (KJOC score) was developed for assessing performance and function in overhead athletes with shoulder and elbow injury and recently adapted as the standard score for overhead athletes in Major League Baseball. However, the Korean version of the KJOC score was not developed in the literature. The aim of the current study was to adapt the English version of the KJOC score to develop a Korean version (K-KJOC) and to evaluate its validity and reliability.

Methods: A total of 52 professional baseball players in the Korean Baseball League completed the K-KJOC at two-week intervals during the off-season. The QuickDASH (11-point Disabilities of the Arm, Shoulder and Hand) score was also performed to evaluate the construct validity of the K-KJOC score. The internal consistency of reliability and test-retest reliability were assessed as well.

Results: The K-KJOC score was correlated with the Quick DASH – disability/symptom ($r = -0.309$, -0.268 , $p < 0.05$), Quick DASH – work ($r = -0.721$ to -0.671 , $p = 0.000$) and QuickDASH – sports ($r = -0.721$ to -0.714 , $p = 0.000$). The internal consistency of the K-KJOC score was excellent (Cronbach's α : 0.917–0.966), and the intra-class correlation coefficients of test-retest reliability for the 10 items for the K-KJOC score were fair to excellent (ICC 0.505–0.937, $p < 0.05$).

Conclusion: The K-KJOC score appeared to be a valid and reliable tool for assessing shoulder and elbow injuries in Korean overhead athletes.

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Sports-specific instruments for evaluation of performance as well as functional status of overhead athletes are limited and the traditional evaluation for recovery from previous musculoskeletal injuries has been described with the term 'return to play'.^{1,8}

The Institutional Review Board of Myongji Hospital approved this study: No. MJH-16-106.

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The development of instruments to detect the subtle change of sports-related functions in athletes^{1,8} might be more difficult than the development of functional outcome instruments in the average population due to the limited knowledge of sports and athletes. Therefore, the commonly used functional outcome instruments in specific diseases, such as the ASES (American Shoulder and Elbow Society) form, the Mayo elbow performance score, and DASH (Disabilities of Arm, Shoulder and Hand), have been used for the functional evaluation of overhead athletes up to date.¹⁸ The other well-known previous functional evaluation tools for overhead athletes were return-to-sport rate, the Conway-Jobe score and the Timmerman-Andrews score.^{3,5,18,19,24,25} The Conway-Jobe score was used to assess outcomes in throwing athletes after ulnar collateral ligament (UCL) repair or reconstruction^{3,5,24} and the Timmerman-Andrews elbow score was developed to evaluate post-traumatic

elbow pain and stiffness or outcome assessment after surgery in throwing athletes.^{5,24,25} However, those scoring systems were limited to use only in elbow injuries excluding shoulder injuries and have never been validated and tested for reliability.²⁴

Since the development of the Kerlan-Jobe Orthopedic Clinic shoulder and elbow (KJOC) score in 2010, several studies adopted this evaluation instrument and proved it to be valid, reliable, and responsive in shoulder and elbow injuries of various overhead athletes.^{1,3,7–9,12,20,21,23,26,28} Furthermore, the Major League Baseball (MLB) organization adopted this evaluation tool as the standard for the recovery of injuries in MLB players recently. However, the KJOC score has never been translated into other languages before, although the international transfer among overhead athletes occurs in various sports and sports related shoulder and elbow injuries in overhead athletes are prevalent worldwide. We hypothesized that the linguistic and cultural adaptations of the KJOC score into the Korean language would be valid and reliable to administer to Korean overhead athletes.

The aim of this study is to develop the Korean version of the KJOC (K-KJOC) score through cross cultural adaptation and verify validity and reliability in Korean professional baseball league players.

Materials and methods

After IRB approval, consent was obtained from every subject involved in this study. The development of the (K- KJOC) score was allowed by the Kerlan-Jobe Orthopedic Clinic in 2015. The current study was conducted in two phases. The first phase comprised the linguistic and cultural adaptation of the English version of the KJOC score into Korean to develop the Korean version of the KJOC score. The second phase comprised administration of the K-KJOC score to Korean overhead athletes, who were professional baseball players, to verify construct validity and reliability.

Adaptation and development of the K-KJOC score

After the permission of the Kerlan-Jobe Orthopedic Clinic, forward translation into Korean was performed by two bilingual Korean–American translators whose first language was Korean. One translator was registered with a Korean professional baseball team (LG Twins) as an official translator with no medical background and the other was a medical researcher. Those two translations were reviewed and a synthesized edition was created. A couple of discrepancies were resolved by consensus. Subsequently, backward translation into English was performed by two independent translators, whose first language was English and who were completely unknown to this study. The backward translations were reviewed for their linguistic and cultural qualities by members of a committee consisting of health professionals, translators, and linguists. Discrepancies were resolved by consensus to achieve a conceptual equivalence with the original questionnaire. The pre-final version was developed and administered as a pilot study to 10 Korean professional baseball players. Further modifications were then made with the assistance of two athletic trainers. The final version was confirmed by the members of the committee.

Subjects

A total of 52 professional baseball players in the Korean baseball league (age, 24.1 [SD 3.8] years; career, 14.0 [SD 4.0] years; catchers 5, infielders 12, outfielders 11, pitchers 24) were enrolled in this study. Twenty-seven of the 52 (51.9%) had a history of shoulder or elbow injury (shoulder, 10; elbow, 17). Eighteen (34.6%) had a history of surgery and 16 of 18 had undergone elbow surgery

Table 1

Summary of baseline characteristics, history of arm injury, and surgery

Age	24.1 (SD 3.8) years			
Gender	All male			
Career	14.0 (SD 4.0) years			
Position	Catcher	5		
	Infielder	12		
	Outfielder	11		
	Pitcher	24		
	Shoulder (n = 10)	Catcher 0 Infielder 2 Outfielder 3 Pitcher 5		
Previous injury	Elbow (n = 17)	Catcher 1 Infielder 3 Outfielder 3 Pitcher 10		
	Surgery	MCL reconstruction (n = 9)	Catcher 0 Infielder 3 Outfielder 1 Pitcher 5	
			Osteophyte removal (n = 2)	Catcher 0 Infielder 1 Outfielder 0 Pitcher 1
			MCL reconstruction + Osteophyte removal (n = 5)	Catcher 1 Infielder 0 Outfielder 2 Pitcher 2
			SLAP lesion repair (n = 2)	Catcher 0 Infielder 1 Outfielder 0 Pitcher 1

MCL, medial collateral ligament; SLAP, superior labrum anterior and posterior.

(Table 1). The athletes completed the K-KJOC questionnaire at two week intervals during off-season. At the first administration of the K-KJOC score, the QuickDASH (11-point Disabilities of the Arm, Shoulder and Hand) score was also administered for the verification of construct validity.

The KJOC score was divided into five sections as follows: 1) questions related to the history of injuries to the arm, 2) description of the level of competition in the current sport, 3) description of the current status (three categories [or groups]; group A, playing without any arm trouble; group B, playing, but with arm trouble; group C, not playing due to arm trouble), 4) questions concerning physical functioning under game and practice conditions, and 5) specific questions referring to the level of competition in the sport. Divisions 4) and 5) were composed of 5 items each and each item was scored on a scale of 0 to 10 (10 is the untroubled state).

Assessment of validity and reliability

Construct validity

To measure construct validity, the correlation was assessed with Quick. QuickDASH – disability/symptom had 11 items to measure the physical function and symptoms of subjects with musculoskeletal disorders in the upper limb (score: 0–55, 0 is best and 55 is worst outcome). There were two optional modules in QuickDASH which were modules of athletes, performing artists, or sports/music module (QuickDASH – sports, 4 items) and workers with high degree of physical performance or work module (QuickDASH – work, 4 items).

Reliability

The internal consistency of reliability was assessed for each item of the K-KJOC score by Cronbach's alpha. To prove the test–retest reliability, the K-KJOC score was administered to the same subjects at two week intervals and analyzed by the intra-class correlation coefficient (ICC) for each item.

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