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Transcultural adaptation and testing of psychometric properties of the Korean version of the Hip Disability and Osteoarthritis Outcome Score (HOOS)

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SUMMARY

Objective: Translation and transcultural adaptation of the Hip Disability and Osteoarthritis Outcome Score (HOOS LK 2.0) into Korean language was performed, followed by test of psychometric properties.

Design: A Korean version of the HOOS was produced according to internationally recommended guidelines, which included forward translation, reconciliation, back translation, harmonization, cognitive debriefing and proof reading. The psychometric properties including reliability and validity were evaluated. The reliability, including the internal consistency and test–retest reliability, was then evaluated in a hip osteoarthritis population (OA group, $n = 75$). The validity, including the convergent validity was assessed comparing HOOS with the Short Form-36 (SF-36) and pain on a visual analogue scale (VAS) scale. Responsiveness was evaluated in a population scheduled for total hip arthroplasty (THA group, $n = 35$).

Results: All subscales of the HOOS showed satisfactory internal consistency (Cronbach's $\alpha > 0.7$) without floor and ceiling effects. Intraclass correlation coefficient (ICC) spanned from 0.78 to 0.93. In terms of convergent validity, Activity of Daily Living (ADL) subscale showed the strongest correlations with Physical Function (PF) ($r = 0.801$) and Bodily Pain (BP) ($r = 0.810$) in the subscales of SF-36. For responsiveness, all HOOS subscale scores improved significantly ($P < 0.05$) postoperatively.

Conclusions: The Korean version of HOOS showed satisfactory internal consistency, test–retest reliability, convergent validity, and responsiveness. This study shows that the HOOS questionnaire developed in West is, with transcultural adaptation, relevant for use among patients in East Asia.

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Introduction

Hip osteoarthritis (OA) is a major cause for chronic disability worldwide, and significantly influences the health-related quality of life. To measure health-related quality of life in patients with hip OA, various assessment tools and questionnaires have been established and are now used by clinicians worldwide.

The Hip Disability and Osteoarthritis Outcome Score (HOOS) questionnaire was developed as an extension of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire, which has been used worldwide as a hip OA specific questionnaire¹, to provide improved validity for young and active patients with high Physical Function (PF) demands^{2,3}. The HOOS includes five subscales, i.e., Symptoms, Pain, Activity of Daily Living

(ADL), Sports/Recreation, and Quality of Life (QoL). The Symptoms and Pain subscales of the HOOS is constituted by the original WOMAC Stiffness and Pain subscales, with three and five additional questions, respectively^{2,4}. The ADL subscales corresponded to the Function subscales of the original WOMAC (17 items), and Sports/Recreation and QoL subscales were newly generated^{2,4}. The instrument is a self-reported questionnaire. We used the Likert format of HOOS 2.0 with five verbal alternatives on each item, and each subscale was transformed from the worst to best on a 0–100 scale.

For a wider application of the assessment tools and questionnaires worldwide, translation and transcultural adaptation from the original version is necessary. Original developers recommend complying with international guidelines with respect to the translation and transcultural adaptation of questionnaires, to maintain essential equivalence in terms of semantic, idiomatic, experiential, and conceptual aspects⁵. In addition, an investigation of the psychometric properties is required. Psychometric validation is a process by which an instrument is assessed for reliability and validity tests on a population for whom the instrument is intended. Reliability refers to the reproducibility, consistency and the homogeneity of the instrument.

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For the reliability test, there are several parameters, such as the test–retest, inter-rater reliability and internal consistency. Validity is an assessment of whether an instrument measures what it aims to measure. Validity is presented as face, content, concurrent, criterion, construct (convergent and discriminant) and predictive validity, and an instrument should also be responsive^{6,7}.

Previous studies have already shown that the original version of HOOS is valid in hip OA patients and responsive to total hip arthroplasty (THA), and that it is useful for evaluating patient-relevant outcomes^{2,3}. Translation and transcultural adaptation of the HOOS has been demonstrated in Europe, where the reliability and validity have been tested in the French and Dutch language^{4,8}. However, the relevance of the HOOS had not been tested in the East Asian populations, where the cultural background is much different.

The aim of this study was to translate and transculturally adapt the HOOS questionnaire into Korean in accordance with international published recommendations⁵, and to test the psychometric properties of the Korean version of HOOS, in terms of the reliability and validity.

Methods

The study was divided into two parts: (1) translation and transcultural adaptation of the English version of HOOS instrument into the Korean language and (2) the test of the psychometric properties of the Korean version of HOOS.

Translation and transcultural adaptation

In this study, the HOOS LK 2.0 English version was used as the source version. Translation and transcultural adaptation was conducted according to standardized international recommendations⁵. Permission was obtained from the developer to use and translate the HOOS into Korean by using the international guideline.

Forward translation and reconciliation

Two persons (native Korean speakers fluent in English; one orthopedic surgeon, and one non-orthopedic translator) independently translated the English version of HOOS into Korean.

At a consensus meeting attended by the two translators who performed the forward translation, and three orthopedic surgeons (KM, DG, and MS), a single Korean version was obtained by reconciling these two Korean versions.

Backward translation

The reconciled Korean version was then back translated into English by two bilingual native English speakers, who were both Korean–Americans fluent in Korean (one a medical personnel, and the other non-medical personnel), blinded to the original English version.

Harmonization

The back translated and original versions of the HOOS were reviewed by a consensus committee, which included the two translators, three orthopedic surgeons, one medical professional (a Korean dentist with English as a first language), a native Korean English non-medical professional who specialized in educational psychology, and a research assistant who specialized in orthopedic scoring systems.

Each committee member independently compared the back translated and original HOOS versions on an item-by-item basis, and scored equivalence with the originals semantically, idiomatically,

experientially, and conceptually⁵, as following; ‘not equivalent at all’ (0), ‘mildly equivalent’ (1), ‘moderately equivalent’ (2), ‘nearly equivalent’ (3), and ‘totally equivalent’ (4). After individual item scores had been averaged, translated Korean expressions for items with an average equivalence score of less than 3 (nearly equivalent) were discussed and revised to establish the final Korean version of the HOOS.

Cognitive debriefing and proof reading

The final Korean version was pre-tested in 15 Korean outpatients visiting the Department of Orthopedic Surgery at our hospital. The patients completed the questionnaire and were then interviewed for full comprehension and any difficulties in the completion of the Korean version. When necessary, ambiguous expressions were modified by discussion. The final Korean version of HOOS was reviewed and corrected.

Test of the psychometric properties of the final Korean version of HOOS

Two study populations with hip OA participated in this study to evaluate the Korean version of the HOOS between March 2010 and August 2010.

The first group (OA group) consisted of patients who visited our outpatient clinics for hip OA according to a Kellgren & Lawrence score of grade 3 or more. The reliability (internal consistency and test–retest reliability) was evaluated in the first group. At the initial assessment, 75 patients were invited to complete the Korean HOOS. Of them, 25 patients were invited for the test–retest reliability and given a second HOOS questionnaire 3 weeks later in the outpatient clinics. Three weeks were considered long enough to prevent recall, but sufficiently short to ensure that the hip status would not change significantly⁹.

The second group (THA group) consisted of patients who were planning to undergo THA due to primary or secondary hip OA. Thirty five patients were invited to participate in this study. The validity (convergent validity and responsiveness) was evaluated in the second group. In addition to the Korean version of the HOOS questionnaire, the patients were asked to complete the Short Form-36 (SF-36) questionnaire and a pain visual analogue scale (VAS) score preoperatively and at 3 months after THA.

The SF-36 is a valid and reliable generic health status questionnaire, that contains eight subscales (PF, Role limitations because of physical problems (RF), Bodily Pain (BP), General Health perception (GH), Vitality (VT), Social Function (SF), Role limitations because of Emotional problems (RE), Mental Health (MH))¹⁰. The pain VAS score is a simple method measuring the severity of pain¹¹.

This study was approved by the institutional review board at our hospital, and informed consent was obtained from all patients.

Statistical analysis

Floor and ceiling effects, which can influence the reliability and validity, were calculated. When more than 15% of the respondents reached the highest or lowest possible score, floor and ceiling effects were considered present¹².

To test the psychometric properties, the internal consistency, test–retest reliability, convergent validity and responsiveness to THA were evaluated. The internal consistency, which is the degree of homogeneity of the items within each subscale, was assessed by using Cronbach’s alpha coefficient. A Cronbach’s alpha coefficient of ≥ 0.7 was considered satisfactory¹³. The test–retest reliability, which is stability across repeated measurements, was evaluated using the Intraclass correlation coefficient (ICC) (two-way random

Table I
Items with equivalence score less than 3 (nearly equivalent)

Question	Mean equivalence score	Concerns	Solution
S1 Do you feel grinding, hear clicking or any other type of noise from your hip?	2.8	There are no Korean expressions that correspond exactly to "feel grinding, and hear clicking".	A liberal translation was made.
S5 How severe is your hip stiffness after sitting, lying or resting later in the day?	2.8	There are no Korean expressions that correspond exactly to "stiffness" in the general population, even though there is a medical term.	A liberal translation was made.
P3 Bending your hip fully	2.8	There are several Korean expressions that correspond to "bending" for general population.	A liberal translation was made.
P6 At night while in bed	2.9	Many Korean people do not use a "bed", in terms of experiential equivalence.	"Bed" was removed in the Korean version.
A10 Rising from bed	2.8	Many Korean people do not use a "bed", in terms of experiential equivalence.	Korean expression corresponding to "floor" was added to the Korean version.
A12 Lying in bed (turning over, maintaining hip position)	2.6	A liberal translation was necessary, in terms of idiomatic equivalence.	A liberal translation was made.
Q2 Have you modified your life style to avoid activities potentially damaging to your hip?	2.6	Many Korean people do not use a "bed", in terms of experiential equivalence.	A liberal translation was made.
Q3 How much are you troubled with lack of confidence in your hip?	2.5	A liberal translation was necessary, in terms of idiomatic equivalence.	A liberal translation was made.

Table II
Characteristics of the OA and THA groups

	OA group	THA group
Number of patients (female/male)	75 (41/34)	35 (18/17)
Mean age (years) (range)	52.6 (37–76)	52.5 (32–76)
Mean BMI (kg/m ²) (range)	24.1 (16.2–30.9)	24.5 (18.5–31.2)

effect model, assuming a single measurement and absolute agreement) with 95% confidence intervals (CI). ICC of >0.70 were considered to indicate good reliability⁷. The convergent validity, which is a type of construct validity, suggests that the value of one parameter would have a quantitative relationship with another similar value of a different parameter. To measure the convergent validity, the correlation between the results of all HOOS subscales and the subscales of the SF-36 questionnaire and pain VAS scores was tested using the Spearman's rank correlation. A Spearman's rho of >0.50, 0.35–0.50, and <0.35 were considered strong, moderate, and weak correlations, respectively¹⁴. The responsiveness, which is a measure of the changes that occur in an individual over a period of time, was evaluated by comparing the pre-THA and 3 months post-THA results of the HOOS, as determined using the Wilcoxon Signed Ranks test.

Statistical analysis was performed using SPSS ver 15.0 (SPSS, Chicago, IL, USA), and *P* values of <0.05 were considered significant.

Results

Translation and transcultural adaptation

During the harmonization process for transcultural adaptation, the average of the transcultural equivalence scores was less than 3 (nearly equivalent) in eight items (S1, S5, P3, P6, A10, A12, Q2, and Q3) (Table I). During the discussion for these items, the committee checked that the translation was comprehensive and verified the transcultural equivalence of the original English and final Korean versions.

Test of the psychometric properties of the final Korean version of HOOS

A total 110 patients were recruited and evaluated; 75 in the OA group (mean age 52.6 years, standard deviation 12.2, and range 37–76) and 35 in the THA group (mean age 52.5 years, standard deviation 14.2 years, and range 32–76) (Table II).

In the OA group, all 75 patients completed the questionnaires for internal consistency. Of the 25 patients who agreed to undergo a further evaluation for the test–retest reliability, three patients refused to complete the retest questionnaires, and one patient did not revisit 3 weeks later. Therefore, the test–retest reliability was evaluated in 21 patients. In the THA group, out of 35 patients who were evaluated preoperatively, 34 patients completed the HOOS, SF-36 questionnaire and pain VAS score, postoperatively. Accordingly, the convergent validity was analyzed in 35 patients evaluated

Table III
Internal consistency of the 5 HOOS subscales, *n* = 75

HOOS subscales (number of items)	Cronbach's alpha coefficient
Symptoms (5)	0.755
Pain (10)	0.927
ADL (17)	0.964
Sport/Recreation (4)	0.875
QoL (4)	0.800

Table IV

Median, interquartile range (IQR) at baseline and 3 weeks later and test–retest reliability for the 5 HOOS subscales, $n = 21$, transformed to 0–100, worst to best

HOOS subscales (number of items)	Baseline median (IQR)	Retest median (IQR)	ICC agreement (95% CI)
Symptoms (5)	55.0 (35.0–80.0)	60.0 (30.0–75.0)	0.894 (0.759–0.956)
Pain (10)	45.0 (27.5–70.0)	45.0 (25.0–65.0)	0.929 (0.836–0.971)
ADL (17)	52.9 (25.0–67.6)	45.6 (25.0–69.1)	0.900 (0.770–0.958)
Sport/Recreation (4)	25.0 (18.8–50.5)	25.0 (12.5–50.0)	0.914 (0.803–0.964)
QoL (4)	25.0 (12.5–31.3)	25.0 (18.8–31.3)	0.781 (0.540–0.904)

preoperatively, and the responsiveness was evaluated in 34 patients using both preoperative and postoperative questionnaires.

No floor or ceiling effect was observed. Cronbach's alpha was highest in the ADL subscale (0.964) and was above 0.70 in other subscales (range 0.755–0.927), indicating a satisfactory internal consistency (Table III). For the test–retest reliability, the Pain subscale showed the highest agreement (ICC = 0.929), and the QoL subscale showed the lowest (ICC = 0.781), indicating good test–retest reliability in all subscales (Table IV). In terms of the convergent validity, the ADL subscale showed the strongest correlations with the PF ($r = 0.801$) and BP ($r = 0.810$) subscales of SF-36. The Sport/Recreation subscale showed the strongest correlation with the pain VAS scores ($r = -0.622$) (Table V). For responsiveness, all HOOS subscale scores improved significantly ($P < 0.05$) after THA (Table VI).

Discussion

In this study, HOOS was translated into the Korean language and transcultural adaptation was performed according to internationally published guideline. Subsequently, the validity of the final Korean version was assessed. Based on the results of this study, the Korean version HOOS was found to be a reliable and valid questionnaire without floor and ceiling effects, like other language versions of HOOS^{2,4,8}.

The internal consistency results were comparable to those observed in other language versions of the HOOS^{4,8}. Cronbach's alpha was greatest for the ADL subscale (0.964), which concurs with previous validation studies (0.94 in French version, and 0.98/0.95 for OA/THA group in Dutch version)^{4,8}. Although a Cronbach's alpha coefficient of ≥ 0.7 indicates satisfactory internal consistency¹³, an excessively high value means that the items are redundant for a single subscale. Considering high value of Cronbach's alpha coefficient (0.94–0.98)^{4,8}, it is possible that some redundant questions were included in the 17 items of the ADL subscale. Further studies on this issue will be necessary. Although,

the unidimensionality of the items in the Symptoms subscale is controversial in the French version (0.66 in French version and 0.95/0.94 for OA/THA group in Dutch version)^{4,8}, the internal consistency of those were satisfactory (0.755) in the Korean version of the HOOS.

For convergent validity, the correlation between the Pain subscale ($r = 0.764$) and BP subscales of SF-36 was lower than that of the ADL subscale ($r = 0.810$), which was also observed in studies of the other language versions of the HOOS^{3,8}.

This study has a limitation. The patients recruited in this study visited our clinics for symptomatic hip OA, and may represent more severe OA, particularly in the THA group. Therefore, our analysis of the floor effect may be less meaningful.

To the best of our knowledge, this is the first study adapting and validating the HOOS in Asia.

During the translation and transcultural adaptation process, some items of the HOOS require careful discussion to ensure that their meanings are accurately retained.

Most importantly, many Koreans cannot understand the anatomic term "hip", and use other terms, corresponding to the buttocks, groin, inguinal, and thigh to indicate the hips. Therefore, we added a sentence defining "hip" on the header of the Korean HOOS. Similarly, in the Symptom subscale, there are no Korean expressions that correspond exactly to "feel grinding, and hear clicking".

In addition, Korean culture differs substantially from that in the West, particularly in terms of the requirement to squat or sit in the tailor position. Although "bed" appears three times in the original HOOS (P6, A10, and A12), unlike the West, many Asian populations do not use a bed, and have a life style that involves sitting on the floor. Moreover, many Korean people do not use a bed, but rather use the underfloor heating system, called "Ondol", which is the traditional living space for sitting, eating, sleeping and pastimes, and requires squatting or sitting in the tailor position, similar to "Tatami" in Japan. Indeed, the average of the transcultural equivalence scores for all three items including "bed" were less than 3 (nearly equivalent) in this study.

All these cross-language and transcultural issues were addressed and discussed to achieve consensus during the process. Nevertheless, this study shows that the HOOS is relevant to hip OA in Far Eastern populations after carrying out the required translation and transcultural adaptation. This is encouraging as the HOOS is useful in both Western and Eastern countries.

In the present study, HOOS was translated and adapted transculturally to the Korean language according to international guidelines. Furthermore, the Korean version of the HOOS demonstrated relevant internal consistency, reliability, convergent validity, and responsiveness that was, comparable to other languages.

Table V

Convergent validity determined as the Spearman's rank correlation between each subscale of the Korean HOOS and SF-36 and pain on a VAS scale, $n = 35$

SF-36 subscale	HOOS					Total HOOS
	Symptoms	Pain	ADL	Sport/Recreation	QoL	
PF	0.505 ($P = 0.002$)	0.762 ($P < 0.001$)	0.801 ($P < 0.001$)	0.576 ($P < 0.001$)	0.614 ($P < 0.001$)	0.773 ($P < 0.001$)
RF	0.247 ($P = 0.159$)	0.386 ($P = 0.024$)	0.440 ($P = 0.009$)	0.312 ($P = 0.072$)	0.345 ($P = 0.046$)	0.418 ($P = 0.014$)
BP	0.736 ($P < 0.001$)	0.764 ($P < 0.001$)	0.810 ($P < 0.001$)	0.753 ($P < 0.001$)	0.757 ($P < 0.001$)	0.856 ($P < 0.001$)
GH	0.106 ($P = 0.557$)	0.074 ($P = 0.684$)	0.118 ($P = 0.512$)	0.169 ($P = 0.346$)	0.159 ($P = 0.378$)	0.115 ($P = 0.525$)
VT	0.206 ($P = 0.251$)	0.198 ($P = 0.269$)	0.220 ($P = 0.219$)	0.305 ($P = 0.084$)	0.104 ($P = 0.564$)	0.197 ($P = 0.272$)
SF	0.345 ($P = 0.046$)	0.255 ($P = 0.145$)	0.331 ($P = 0.056$)	0.342 ($P = 0.047$)	0.239 ($P = 0.147$)	0.316 ($P = 0.068$)
RE	0.353 ($P = 0.040$)	0.332 ($P = 0.055$)	0.370 ($P = 0.031$)	0.389 ($P = 0.023$)	0.316 ($P = 0.069$)	0.387 ($P = 0.024$)
MH	0.245 ($P = 0.170$)	0.254 ($P = 0.153$)	0.238 ($P = 0.183$)	0.317 ($P = 0.072$)	0.272 ($P = 0.125$)	0.223 ($P = 0.212$)
Pain VAS	-0.507 ($P = 0.004$)	-0.611 ($P < 0.001$)	-0.565 ($P = 0.001$)	-0.622 ($P < 0.001$)	-0.165 ($P = 0.384$)	-0.605 ($P < 0.001$)

Table VI
Responsiveness of the Korean HOOS subscales. *n* = 34

HOOS subscale	Preop median (IQR)	Postop median (IQR)	<i>P</i> -value
Symptoms (5)	47.5 (20.0–70.0)	75.0 (55.0–80.0)	0.009
Pain (10)	35.0 (21.5–49.0)	75.0 (68.8–82.8)	0.001
ADL (17)	45.5 (16.5–50.3)	75.0 (58.3–79.8)	0.001
Sport/Recreation (4)	22.0 (4.5–50.0)	75.0 (40.8–76.5)	0.003
QoL (4)	15.5 (4.5–32.8)	53.0 (36.3–63.8)	0.002

Author contributions

The following authors have made substantial contributions to the following: (1) the conception and design of the study (YKL, CYC, KHK, KML, MSP), acquisition of data (YKL, KHK, DJL, SCL), analysis and interpretation of data (YKL, KML, DJL, SCL, MSP), (2) drafting the article (YKL, KML, DJL, SCL, MSP), revising critical for important intellectual content (YKL, CYC, KHK, DJL, SCL, MSP), (3) final approval of the version to be submitted (YKL, CYC, KHK, KML, DJL, SCL, MSP).

Conflict of interest

No benefits in any form have been received or will be received from any commercial party related directly or indirectly to the subject of this article. The authors have full control of all primary data and agree to allow the journal to review this data.

All authors certify that his or her institution approved the human protocol used in this investigation, all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study had been obtained from all patients.

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