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Brief report

Cross-cultural adaptation and validation reliability, validity of the Japanese version of the Hip disability and Osteoarthritis Outcome Score (HOOS) in patients with hip osteoarthritis

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Introduction and summary

Hip osteoarthritis (OA) is one of the leading causes of chronic disability worldwide and has a significant impact on patients' health-related quality of life (HRQoL). To assess major factors of patients' limitations, the Hip disability and Osteoarthritis Outcome Score (HOOS) has been developed in English[1] to improve the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[2] for the use in patients with higher physical demands. As no Japanese version of the HOOS was available, the goal of the study was to cross-culturally adapt and validate the HOOS for its use in a large number of Japanese patients with hip OA[3] based on the guidelines of Guillemin and Beaton[4,5]. Acceptable internal consistency and good test–retest reliability was achieved. As hypothesized, convergent validity was found for all HOOS domains with the Oxford Hip Score (OHS), with the 36-item Short Form (SF-36) subscales for Physical Functioning (PF) and Bodily Pain (BP), and with the subscale for Acceptance of the Nottingham Adjustment Scale Japanese version hip edition (NAS-J-HIP). Divergent validity was also found for the HOOS subscales and SF-36 Role Emotional and Social Functioning subscales. The responsiveness was high for all subscales in OA patients after total hip arthroplasty (THA) ($n = 21$). Overall, the Japanese HOOS questionnaire is valid and reliable for use in Japanese patients with symptomatic hip OA.

Methods, results and discussion

Cross-cultural adaptation

The translation followed the recommendations for cross-cultural adaptation of HRQoL measures[4,5] with two independent forward translations (one informed Japanese orthopedic surgeon, fluent in English, and one uninformed professional translator, native Japanese speaker studying in England), a consensus meeting, two independent backward translations (two native English speakers fluent in Japanese without medical background), and a second meeting of all persons involved in the translation process. As there are no Japanese expressions that exactly correspond to question S1 ("feel grinding, and hear clicking"), we searched for an echoic word for clicking, "kokku", and mimetic word for feel griding, "feel guriguri". This was implemented in the Japanese version. After testing for comprehensiveness in 54 healthy volunteers, all documents of the cross-cultural adaptation were sent to the developer of the original HOOS (E. Roos). No difficulties were reported.

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Subjects

Inclusion criteria were: Patients older than 25 years, with symptomatic hip OA either scheduled for THA or being treated medically, or patients undergoing THA, who were able to understand and read the national language at an elementary level. A total of 162 patients, i.e., 45 OA patients scheduled for THA (group 1 = "OA group") and 117 patients after THA (group 2 = "THA group") who were visiting a single orthopedic clinic were enrolled (supple Table 1). The mean age was 62.0 years (range 26–83 years). The mean follow-up period of THA group patients was 6.6 years (range 0.3–18.5 years). The study was approved by the ethical review board of the affiliated organization, and informed consent was obtained. Patients were asked to complete the Japanese versions of the HOOS (n = 162), SF-36, OHS, and NAS-J-HIP questionnaires (n = 127). Two weeks later, they completed the HOOS for a second time and sent it back via post. For the analysis of cross-sectional validity and responsiveness, only data from patients who completed all four questionnaires were used.

Instruments

Each HOOS item (Pain: 10, Symptoms: 5, Activities of daily living (ADL): 17, Sport/recreation: 4, QoL: 4) includes five answer options (Likert boxes) giving a score from 0 to 4. For each domain, scores are normalized from worst to best on a 0–100 scale. Missing values were handled according to HOOS guidelines[1]: when more than two items of a domain were missing, the score was not calculated.

The SF-36 is a valid and reliable generic health status questionnaire that contains eight subscales (PF, Role limitations because of physical problems (RP), BP, General Health (GH) perception, Vitality (VT), Social Function (SF), Role limitations because of Emotional problems (RE), Mental Health (MH))[6]. SF-36 has been validated for use in Japan[7].

The OHS comprises 12 items assessing pain and function of the hip and has been validated for OA and THA patients[1,8–10]. Each item is rated on a 0- to 4-Likert scale. The measure generates a single overall score ranging from 0 to 48 (summed items) where the higher the score, the best the health state. Japanese version of the OHS has been validated in Japan[11].

The Nottingham Adjustment Scale was initially developed to measure psychological adaptation to acquired visual impairment[12]. As suggested by the developers, it has been adopted for other areas of acquired disability. In the present study, the Japanese version adopted for hip OA (NAS-J-HIP) has been used. It consists of seven extracted factors including (1) anxiety/depression, (2) self-esteem, (3) attitude, (4) locus of control, (5) acceptance, (6) self-efficacy, and (7) attributional style[13].

Statistical analysis and results

Data were analyzed using SPSS 19.0 (SPSS Inc., Chicago, IL). All tests were two-tailed and conducted at a 5% level of significance.

Feasibility

For both OA and THA groups, few single responses to HOOS items were missing, and the total score was obtained for all domains by all patients except for 0.3% for the Pain subscale, 0.2% for Symptoms, 0.1% for ADL, and 0.6% for Sports/recreation. Floor and ceiling effects were considered present if more than 15% of the respondents achieved the highest or lowest score. A ceiling effect was observed for the Pain (34.0%) and Symptoms (21.0%) subscales; for THA group patients only, this effect was seen in 47.0% and 29.1%, respectively. No ceiling effect was observed in the OA group. In both groups, no floor effect was observed for any HOOS subscale.

Internal consistency

Internal consistency was assessed using Cronbach's alpha coefficient with 95% confidence intervals (95% CI). Values equal to or above 0.7 indicate acceptable reliability for scales which are used as research tools to compare groups. Cronbach's alpha ranged from 0.78 to 0.97 indicating good homogeneity (Table I).

Test–retest reliability

Reliability of the HOOS subscales was assessed using the intraclass correlation coefficient (ICC) (two way model, single measure) with 95% CI. An ICC of more than 0.80 is considered an indicator of good reliability. In addition, a Bland and Altman was obtained. For all HOOS subscales, the ICCs were good, ranging from 0.90 (QoL) to 0.98 (Pain and ADL) (Table I). The difference between repeated measurements was included within the 95% limits of agreements in most cases presented as Bland and Altman representations (supple Fig. 1), and was not related to the mean of the two measurements considering from the range and the distribution of each HOOS score (Table I).

Construct validity

Construct validity was assessed by correlating the results of the five HOOS subscales with SF-36, OHS, and NAS-J-HIP subscales. The results are shown in Table II. Spearman correlation coefficients of >0.50, 0.35–0.50, and <0.35 were considered strong, moderate, and weak, respectively. A priori hypotheses stated that all HOOS domains would strongly correlate with the SF-36 PF and BP subscales and with OHS. This could be confirmed. Expected divergent correlations between all HOOS subscales and the RE and SF subscales of SF-36 were found between the HOOS Pain subscale and the SF-36 SF, RE and MH subscales. An unexpected moderate correlation for SF (0.41) and MH (0.42) with HOOS-ADL was also observed. As a sign for psychological adaptation of patients to their physical limitations, we hypothesized

Table I
Mean and median HOOS scores at the first and second assessment and the test–retest reliability given as ICCs, and internal consistency of five scales as Cronbach's alpha coefficient, N = 162

HOOS subscales	HOOS score				ICC (95% CI)	Cronbach's alpha coefficient (95% CI)
	First assessment		Second assessment			
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)		
Pain (10)	85.3 (19.8)	95.0 (75.6–100.0)	84.6 (20.7)	92.5 (77.5–100.0)	0.98 (0.96–0.98)	0.95 (0.92–0.95)
Symptoms (5)	77.7 (22.6)	85.0 (65.0–95.0)	76.9 (23.1)	85.0 (65.0–95.0)	0.94 (0.92–0.95)	0.86 (0.81–0.88)
ADL (17)	79.1 (19.9)	85.0 (71.0–94.0)	78.7 (20.3)	84.0 (71.0–94.0)	0.98 (0.97–0.98)	0.97 (0.94–0.96)
Sport/recreation (4)	57.3 (29.0)	62.5 (37.5–81.3)	58.3 (28.6)	62.5 (31.3–81.3)	0.95 (0.91–0.95)	0.89 (0.81–0.89)
QoL (4)	61.2 (24.2)	69.0 (44.0–75.0)	61.0 (25.8)	69.0 (44.0–81.0)	0.90 (0.87–0.92)	0.78 (0.70–0.82)

IQR, interquartile range.
Two assessments were calculated for 162 patients, separated with an interval of 1–2 weeks (median 8, min 7, max 14 days).

Table II
Construct validity determined as Spearman correlation between subscales of the Japanese HOOS and SF-36, OHS and NAS-J-HIP for the hip OA patients, $N = 127$

HOOS	Pain	Symptoms	ADL	Sport/recreation	QoL
SF-36 subscales					
Physical function	**0.46 (P < 0.001)**	**0.42 (P < 0.001)**	**0.61 (P < 0.001)**	**0.50 (P < 0.001)**	**0.42 (P < 0.001)**
Role physical	0.34 ($P < 0.001$)	0.22 ($P < 0.005$)	**0.43 (P < 0.001)**	0.27 ($P < 0.001$)	0.33 ($P < 0.001$)
BP	**0.53 (P < 0.001)**	**0.41 (P < 0.001)**	**0.43(P < 0.001)**	0.27 ($P < 0.001$)	0.33 ($P < 0.001$)
GH	0.22 ($P < 0.001$)	0.27 ($P < 0.001$)	0.31 ($P < 0.001$)	0.25 ($P < 0.001$)	0.11
VT	0.34 ($P < 0.001$)	0.34 ($P < 0.001$)	**0.40 (P < 0.001)**	0.29 ($P < 0.001$)	0.26 ($P < 0.001$)
Social functioning	0.29 ($P < 0.001$)	0.36 ($P < 0.001$)	**0.41 (P < 0.001)**	0.22 ($P < 0.005$)	0.23 ($P < 0.001$)
Role emotional	0.28 ($P < 0.001$)	0.18 ($P < 0.001$)	0.33 ($P < 0.001$)	0.17	0.21 ($P < 0.001$)
MH	0.32 ($P < 0.001$)	0.33 ($P < 0.001$)	**0.42 (P < 0.001)**	0.31 ($P < 0.001$)	0.26 ($P < 0.001$)
OHS	**0.74 (P < 0.001)**	**0.65 (P < 0.001)**	**0.81 (P < 0.001)**	**0.60 (P < 0.001)**	**0.61 (P < 0.001)**
NAS-J-hip					
Anxiety/depression	0.33 ($P < 0.001$)	0.35 ($P < 0.001$)	0.40 ($P < 0.001$)	0.22 ($P < 0.005$)	0.27 ($P < 0.001$)
Self-esteem	0.28 ($P < 0.001$)	0.31 ($P < 0.001$)	0.29 ($P < 0.001$)	0.12	0.04
Attitude	0.16	0.30 ($P < 0.001$)	0.22 ($P < 0.005$)	0.20 ($P < 0.005$)	0.20 ($P < 0.005$)
Locus of control	0.21 ($P < 0.005$)	0.20 ($P < 0.005$)	0.26 ($P < 0.001$)	0.12	0.03
Acceptance	**0.48 (P < 0.001)**	0.35 ($P < 0.001$)	**0.42 (P < 0.001)**	0.29 ($P < 0.001$)	0.36 ($P < 0.001$)
Self-efficacy	0.11	0.12	0.13	0.08	−0.03
Attributional style	−0.09	−0.02	−0.06	−0.01	−0.03

Numbers above 0.4 for correlation were expressed in bold.

that the Acceptance subscale of the NAS-J-HIP correlates with the HOOS Pain and ADL subscales. This was confirmed and corresponds with the findings of a study comparing the NAS-J-HIP with subscales (Pain, Range of motion, Walking, and ADL) of the Japanese Hip Society's Evaluation Chart of Hip Joint Functions[13].

Responsiveness

Responsiveness was evaluated in 21 OA patients of group 1 by comparing the HOOS scores before and after THA (3–16 months after surgery; median of 7 months) with the Wilcoxon Signed Rank test. The standardized response mean, i.e., the mean change between baseline and follow-up divided by the standard deviation (SD) of this change, and the effect size, i.e., the mean score change between baseline and follow-up divided by the SD of the baseline values, were also calculated. After the OA patients underwent THA, all HOOS subscale scores improved significantly ($P < 0.001$) (supple Fig. 2) with effect sizes ranging from 1.70 to 2.11 and standardized response means ranging from 1.60 to 2.10 (supple Table 2).

Discussion

Japanese culture still differs from that in the West, particularly in terms of the requirement to squat or sit in the tailor position, most often for elderly people. Common lifestyle practices involving sleeping and sitting on the floor are a significant risk factor for THA revision[14,15]. Because of the high number of patients with hip OA in Japan, it is important to have validated instruments that allow patient self-assessments and can be used to compare studies on an international level. Therefore, the HOOS has been cross-culturally adapted into Japanese and validated for the use in patients with symptomatic hip OA.

All questionnaires were completed with a low percentage of missing data. While no floor or ceiling effects were observed for the OA group, a ceiling effect was visible for the Pain and Symptom subscales in the THA group. This is reasonable as a result of pain relief after surgery contrasts with preoperative OA patients suffering from various disabilities.

The internal consistency results were comparable to those observed in other language versions of the HOOS[8–10]. Cronbach's alpha was highest for the ADL subscale (0.97), which concurs with previous validation studies (0.94 in the French version, and 0.98/0.95 for OA/THA group in the Dutch version, 0.96 in the Korean version)[8–10]. Also for the Symptoms subscale, internal consistency was equally satisfactory (0.86) as found in other reports (0.95/0.94 for OA/THA group in the Dutch version, 0.75 in the Korean version)[9,10].

For convergent validity, the correlation between the HOOS and OHS was as good as that in the Dutch version (ICC 0.66–0.88 for the Dutch HOOS)[9]. All five subscales of the HOOS were highly correlated with the PF subscale of the SF-36, and the HOOS subscales of Pain, Symptoms and ADL showed moderate correlations with the BP subscale of the SF-36, which was also found in the Dutch validation[9]. The moderate correlation between the subscales for Pain and ADL of the HOOS and the Acceptance subscale of the NAS-J-HIP may reflect the fact that major symptoms of hip OA are pain and disability of ADL. This supports the idea of Koyama *et al.*[13], who suggested that it might be possible to improve HRQoL by controlling the pain and by promoting acceptance. Further research is necessary to clarify this point.

High responsiveness makes it possible to reduce the number of subjects needed to demonstrate a significant difference between groups. In this study, the HOOS improved significantly after THA as shown in supple Fig. 2, and can therefore be useful for responsiveness evaluation.

Limitations in the study that have an influence on the final interpretations include that: (1) the two groups do not contain the same number of patients, (2) the number of patients for the responsiveness testing is relatively small, (3) there was a wide range of follow-up times for the responsiveness testing (3–16 months) rather than a consistent time (e.g., 3 months), but all will be addressed in future studies, (4) the sample may be of uneven distribution, and not be representative of the Japanese population only including patients waiting for surgery and post-surgery patients, and (5) comparisons to other language cross-cultural adaptations of hip outcome scores are limited with respect to the responsiveness to hyaluronic acid treatment. Although Osteoarthritis Research Society International (OARSI) guidelines for the treatment of the hip OA included the use of visco-supplementation, which aims to restore physiological and rheological features of the synovial fluid, this treatment was not used in Japanese patients and therefore not included in our sample. Cases with such medical treatment will be included in the future study to address the effect of intra-articular hyaluronic acid applications in symptomatic hip joint OA.

Overall, the Japanese version of the HOOS demonstrated good psychometric properties that are comparable to other language versions. We believe that the Japanese HOOS is acceptable for evaluating outcomes in patients with hip OA and OA-related

treatments in Japan, and provides a basis for future clinical trials integrating self-assessments of Japanese patients.

Author contributions

The following authors have made substantial contributions to the following (1) the conception and design of the study (MS, KM, SGO, TK), acquisition of data (MS, KM), analysis and interpretation of data (MS, SGO), (2) drafting the article (MS), revising critical for important intellectual content (MS, KM, SGO, TK), (3) final approval of the version to be submitted (MS, KM, SGO, TK).

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.

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Supplementary data

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