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Original article

Does change in language change the properties of a shortened score previously validated in its complete version? Validation of the French versions of the HOOS-12 and KOOS-12 scores in primary knee and hip arthroplasties

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Abstract

Background

The HOOS and KOOS scoring questionnaires comprise respectively 40 and 42 items; a shorter 12-item version was recently developed, but remains to be validated in a French-speaking population. We therefore conducted a prospective study 1) to determine whether the new 12-item versions in French are equivalent to the longer HOOS and KOOS versions, and 2) to validate the French-language HOOS-12 and KOOS-12 patient-reported outcome

measures in a population of primary total hip and knee arthroplasty: validity, reliability, and responsiveness.

Hypothesis

The change in language in a score already validated in its long version does not alter its properties in the short version.

Material and methods

One hundred patients (59 males, 41 females) undergoing primary total hip arthroplasty and 100 patients (43 males, 57 females) undergoing primary total knee arthroplasty were prospectively included. They filled out the original HOOS or KOOS questionnaires, their simplified versions (PS: Physical function Short form; JR: Joint Replacement) and the short HOOS-12 and KOOS-12 versions, and also the Oxford-12 score assessing the affected joint, preoperatively, then at 6-12 months.

Results

The 100% response rate confirmed ease of use. There were no redundant items. There were strong correlations between the 12-item and longer versions (>0.9). The HOOS-12 and KOOS-12 scores were reliable and valid: 1) there were no ceiling or floor effects for pre- or post-operative KOOS-12 scores, although a ceiling effect was found for HOOS-12 postoperatively (20% of patients having maximum scores of 100); 2) internal consistency was confirmed, with Cronbach alpha >0.8; 3) external consistency between Oxford-12 and HOOS-12/KOOS-12 was excellent, with Pearson correlation coefficient > 0.8. Sensitivity to pre-/post-operative change was confirmed, with effect size > 0.8.

Discussion

The present study confirmed the usefulness of this new 12-item form for HOOS and KOOS. Properties were identical between the French- and English-language versions, authorizing everyday use of these simpler versions.

Level of evidence: IV; prospective study without control group

Keywords: PROM, Hip, Knee, KOOS, HOOS, Total hip arthroplasty, Total knee arthroplasty

1. Introduction

Scoring systems, and patient-reported outcome measures (PROM) in particular, are recommended for patient assessment, and notably for postoperative quality of life [1]. The Hip Osteoarthritis Outcome Score (HOOS) and Knee Osteoarthritis Outcome Score (KOOS) were respectively developed in 2003 and 1998 [2,3]. They comprise respectively 40 and 42 items, in 5 domains: pain (P), symptoms (S), function and activities of daily living (F), sport and leisure activities (SP), and quality of life (Q). Each domain is scored out of 100 points (0 to 100), and results are presented for the 5 domains, without global score.

Simplified versions were developed: PS (Physical function Short form) and JR (Joint Replacement) [4-7]. In 2018, the original team developed 12-item versions, HOOS-12 and KOOS-12 [8-10] (French versions in Appendices 1 and 2), as the short PS and JR versions [4-7] were felt not to provide as full an assessment as the original versions. Redundant items, determined on statistical analysis, were deleted.

Ornetti et al. [11,12] validated French-language versions of HOOS and KOOS and of the short PS version [13]. Item formulations were unchanged in developing the 12-item versions, so no new translation was needed, having already been validated. Nevertheless, transition to French may affect certain properties such as validity, reliability and responsiveness, with potential saturation: i.e., prematurely hitting a ceiling or floor beyond which patients can no longer be differentiated. To our knowledge, these possible effects have not been assessed, and we therefore conducted a prospective study 1) to determine whether the new 12-item versions in French are equivalent to the longer HOOS and KOOS versions, and 2) to validate the French-language HOOS-12 and KOOS-12 questionnaires in a population of primary total hip and knee arthroplasty: validity, reliability, and responsiveness. The study hypothesis was that the change in language in a score already validated in its long version does not alter its properties in the short version, and that the 12-item HOOS and KOOS questionnaires were utilizable in their French versions.

2. Material and methods

2.1 Patients

A prospective study was conducted in the University Hospital of Lille, France (registration n° AC 2017-A01911-52, Clinical Trials NCT04057651). One hundred patients (59 males, 41 females; mean age, 61 ± 11 years [range, 30-85 years]) undergoing primary total hip arthroplasty and 100 patients (43 males, 57 females; mean age, 67±11 years [range, 48-89 years]) undergoing primary total knee arthroplasty were included. All patients were adult (>18 years), with osteoarthritis or osteonecrosis, and provided written consent. Exclusion criteria comprised: lack of national health insurance cover, age <18 years, incapacity to provide consent, pregnancy, and body-mass index > 35 or <18.

2.2 Methods

The HOOS-12 [9] and KOOS-12 [10] self-administered questionnaires, comprising 12 items scored 0-4, were distributed by mail prospectively in paper version on eve of surgery and at a minimum 6 months' follow-up (Appendices 1 and 2). The Oxford-12 [14-16] questionnaire was administered at the same time points, and also the long versions of HOOS [2] and KOOS [3].

HOOS-12 and KOOS-12 comprise 3 domains: pain (P) (4 items), function and activities of daily living (F) (4 items), and quality of life (Q) (4 items) (Appendices 1 and 2). Scores per domain were calculated out of 100 (0-100), as in the original versions, with the mean of the 3 as final HOOS-12/KOOS-12 score. A "global" HOOS KOOS long-version score was likewise calculated out of 100 as the mean of the 5 domains (P+S+F+SP+Q).

2.3 Assessment

Statistical analyses used SPSS software. All tests were 2-tailed, with 5% first-order risk.

Main endpoint assessment was based on the criteria defined by Bouletreau et al. [17] and the COSMIN group [18]: validity, reliability, and responsiveness.

*Validity concerns relevance to the phenomenon under study, and assesses item quality in terms of redundancy. Principal component analysis (PCA) was performed to determine whether items were distributed along a single dimension or as subgroups [19]. Validity also

concerns external consistency, assessed by the correlation with Oxford-12 scores (also comprising 12 items) and with the PS and JR scores derived from the HOOS and KOOS.

* Reliability was assessed as internal consistency on Cronbach alpha, considered good if >0.7 [20].

* Responsiveness was assessed by the difference between preoperative and 6-month scores on Cohen's kappa, with 0.2 as "weak" effect, 0.5 "moderate", and 0.8 "strong" [21].

3. Results

3.1 Distribution of results

Response rate was 100%. There were no floor or ceiling effects preoperatively, but HOOS-12 showed a ceiling effect at follow-up (20% of patients scoring the maximum, 100 points) (Figure 1).

3.2 Validity

PCA revealed a single dimension for both HOOS-12 [9] and KOOS-12 [10], with respectively 50% and 51% of variance explained by the first principal component; There were no redundant items.

External consistency assessment found good correlation for HOOS-12 [9] and KOOS-12 [10] with Oxford-12 score, both pre- and post-operatively (Pearson r, > 0.5). The 12-item versions correlated more strongly with the "global" scores on the HOOS and KOOS long versions, both pre- and post-operatively, than with the PS and JR derivatives. All correlations were significant (p<0.05) (Tables 1 and 2).

3.2 Reliability

Cronbach alpha was good (>0.7), both pre- and post-operatively (Table 3).

3.3 Responsiveness

Pre- and post-operative scores were significantly different. The effect size was strong (>0.8) (Table 4): i.e., HOOS-12 and KOOS-12 were responsive to change.

4. Discussion

The present study demonstrated that the simplified 12-item HOOS and KOOS PROMs were utilizable in their French-language versions. Score properties were unaffected by the translation into French. There were no redundant items: i.e., each item analyzed one aspect of the hip or knee. Principal components analysis revealed a single dimension: i.e., the scores assessed the hip or knee globally. The items selected for the transition from the long to the 12-item versions showed strong correlation with global long-version scores: i.e., the authors' intention to respect the spirit of the original scores in the new short versions was conserved in the French translation. Marot et al. [22] showed that KOOS scores varied with age, gender and body-mass index. It was therefore necessary to validate the new French version, as the translation might betray the intention of the authors of the 12-item versions, despite the initial work by Ornetti et al.[11-13].

Perez et al. [23] did not show the number of items to affect understanding, but nevertheless suggested that fatigue and loss of concentration might affect results quality. Deleting redundant items from the 12-item questionnaires, without affecting the initial properties, makes for greater ease of use. The original authors estimated long-form administration time to average 10 minutes [2,3]; Gudbergsen et al. [24] reported 7 minutes. The 12-item versions are still exhaustive, but save time and avoid having missing data.

The scores proved reliable, valid and sensitive to change. In the present series, data for floor and ceiling effects were comparable for the KOOS-12 postoperatively [10]. In contrast, the ceiling effect rate for HOOS-12 at 1 year was 12-14% for Gandek et al. [9], which was not strictly a ceiling effect as in the present study, but nevertheless not far from the present rate of 20%. This rate was lower than for the other scores derived from HOOS (27-36% for HOOS JR), testifying to the interest of the 12-item version in differentiating patient progression profiles [6,9]. Bourlez et al. [25] showed that the KOOS daily living and quality of life domains

showed ceiling and floor effects. The new 12-item score avoids this limitation of the 5-domain long version.

The present Cronbach alpha results were similar to those of Gandek et al. [9,10], testifying to item homogeneity in the construction of the score and absence of change according to type of population (French- versus English-speaking). Like in the present series, Cronbach's alpha was weaker in the pain (P) questionnaires (close to 0.7) [9,10].

Again like for Gandek et al. [9,10], effect size was greater for the hip than the knee, but still strong (>0.8), testifying to responsiveness. The difference between French- and English-speaking populations did not alter good differentiation according to treatment.

The present study had certain limitations. 1) Reproducibility was not assessed. For PROMs, only intra-observer reproducibility applies, and even this is a question of debate [16]. It was tested on the cross-cultural validation of HOOS and KOOS by Ornetti et al. [11-12]. 2) Sample size is open to discussion, as suggested by Kayaalp et al. [26] in their Letter to the Editor about the French-language validation of the IKS score. Rouquette and Falissard [27] recommended a minimum 300 subjects, but that was for creation and validation rather than cross-cultural validation of a score. The present series was equivalent to or greater than various other reports of score translation into French [15,16,28,29].

5. Conclusion

The simplified 12-item versions of HOOS and KOOS (HOOS-12 and KOOS-12) proved reliable, valid and responsive to change in their French versions. The authors had sought to conserve the philosophy of the original HOOS and KOOS, and translation into French did not affect this. The 12-item versions are easier to use, and can be used in French.

Disclosure of interest: Sophie Putman is a consultant with Corin, but has no conflicts of interest to disclose in relation to the present study. Gilles Pasquier is an education and research consultant for Zimmer, but has no conflicts of interest to disclose in relation to the present study. Henri Migaud is Editor in Chief of Orthopaedics & Traumatology: Surgery &

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Figure legend

Figure 1: Distribution of HOOS-12 and KOOS-12 scores in 100 patients before and after surgery; ceiling effect for postoperative HOOS-12.

Table 1: Correlation between HOOS-12 [9] and Oxford-12 [14], HOOS global score and JR (Joint Replacement) and PS (Physical function Short form) forms, pre- and post-operatively (6 months).

Correlation of HOOS-12 [9] with:	Preoperative	Postoperative
Oxford-12[15]	0.821	0.906
HOOS global (5 HOOS domains) [2]	0.942	0.979
HOOS JR [6]	0.803	0.950
HOOS PS [4]	0.866	0.905

Table 2: Correlation between KOOS-12 [10] and Oxford-12 [16], KOOS global score [3] and JR (Joint Replacement) and PS (Physical function Short form) forms, pre- and post-operatively (6 months).

Correlation of KOOS-12 [10] with:	Preoperative	Postoperative
Oxford-12 [16]	0.828	0.886
KOOS global (5 KOOS domains) [3]	0.953	0.974
KOOS JR [7]	0.920	0.937
KOOS PS [5]	0.933	0.893

Table 3: Cronbach alpha [18] for pre- and post-operative (6 months) scores; good reliability if alpha > 0.7

Coefficient de Cronbach	Preoperative	Postoperative
HOOS-12 [9]	0.893	0.952
HOOS-12 Pain [9]	0.754	0.897
Hoos-12 Function [9]	0.802	0.913
HOOS-12 Quality of life [9]	0.827	0.905
KOOS-12 [10]	0.909	0.948
KOOS-12 Pain [10]	0.772	0.906
KOOS-12 Function [10]	0.813	0.864
KOOS-12 Quality of life [10]	0.782	0.891

Table 4: Responsiveness

	Preoperative (*)	Postoperative (*)	P (+)	Effect size (**)
HOOS-12 [9]	33 +/-14 [4-68]	82 +/-20 [14-100]	<0.001	3
HOOS-12 Pain [9]	38+/-16[0-75]	86+/-20[18-100]	<0.001	2.9
Hoos-12 Function [9]	37+/-16[0-75]	83+/-21[12-100]	<0.001	2.7
HOOS-12 Quality of life [9]	24+/-17[0-75]	77+/-26 [0-100]	<0.001	3
KOOS-12 [10]	32+/-16[0-75]	65+/-24[9-100]	<0.001	2 .06
KOOS-12 Pain [10]	36+/-17[0-85]	71+/-25 [18-100]	<0.001	2.05
KOOS-12 Function [10]	35+/-19[0-85]	65+/-25[0-100]	<0.001	1.57
KOOS-12 Quality of life [10]	25+/-18 [0-81]	59+/-29[0-100]	<0.001	1.88

*: mean +/- standard deviation [range]; +: matched Student test; **: on Cohen criteria, effect size

0.2 is "weak", 0.5 "moderate" and 0.8 "strong" [19].