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ORIGINAL RESEARCH

Are the Harris Hip Score and the Hip Outcome Score valid patient-reported outcome measures for femoroacetabular impingement syndrome?

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Abstract
Background: The International Hip Outcome Tool (iHOT-33) is a reference instrument among the Patient-Reported Outcome Measures (PROMs) to assess people with hip disorders, including femoroacetabular impingement (FAI) syndrome. Older questionnaires such as the Harris Hip Score, or its modified version (mHHS), and the Hip Outcome Score (HOS), through the full version or its subscales (Activities of Daily Living-ADL; and Sports) are still used in the clinical setting and their construct validity is so far underexplored.
Objective: To assess the construct validity of mHHS and HOS-ADL compared with iHOT-33 by hypothesis testing in a large sample of patients with FAI syndrome.
Methods: This retrospective study was conducted with data records from patients with FAI syndrome seeking care at a private physical therapy clinic between 2013 and 2018. All participants completed the three questionnaires (mHHS, HOS-ADL, and iHOT-33) during the physical therapy initial assessment.
Results: From the 523 patients with FAI syndrome found in the clinic's database, 373 were eligible for this study. An acceptable agreement ($r>0.70$) was found between HOS-ADL and iHOT-33 ($r = 0.77$, 95%CI: 0.73, 0.81), but not between mHHS and iHOT-33 ($r = 0.68$, 95%CI: 0.62, 0.73). HOS-ADL score presented an acceptable agreement with iHOT-Symptoms subscale score ($r = 0.78$, 95%CI: 0.73, 0.81), while mHHS score did not ($r = 0.68$, 95%CI: 0.62, 0.73). Neither HOS-ADL or mHHS presented an acceptable agreement with iHOT-Sport, iHOT-Job, or iHOT-Social scores.

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Conclusion: The HOS-ADL score, but not mHSS score, is an acceptable measure of health-related quality of life in patients with FAI syndrome.

Introduction

Femoroacetabular impingement (FAI) syndrome is a movement-related hip disorder.[1,2] Its prevalence ranges from 5% to 75% according to the studied population.[3] FAI syndrome is diagnosed through a triad: symptoms, clinical signs, and imaging findings.[1] The morphological abnormalities (the flattening of the junction between the femoral head and neck, named cam; and the increased acetabular coverage, named pincer) lead to abnormal contact between hip structures causing cartilage damage.[4] People with FAI syndrome experience hip pain, which can also be felt in other regions (i.e., groin, buttock, lateral hip), especially during movements or when keeping specific positions (such as sitting) for long periods.[1,5] They also present decreased mobility and muscle strength, which further impair their function, performance of daily life activities, occupational and sports practice, as well as the quality of life.[5-8]

Scientific evidence is still unclear regarding the best treatment for FAI syndrome.[8-11] The clinical decision to undergo non-surgical or surgical treatment usually depends on subjective aspects related to pain intensity and the syndromes' impact on the patient's quality of life. Therefore, clinicians commonly use Patient-Reported Outcome Measures (PROMs) to help clinical decision-making.[12]

One of the first PROMs used to assess people with hip-related disorders was the Harris Hip Score, which was proposed in 1969.[13] This questionnaire was initially used in patients who underwent total hip arthroplasty.[13] It was then modified to evaluate patients after hip arthroscopy surgery.[14] The modified Harris Hip Score (mHHS) has been widely used in the assessment of patients with a range of hip disorders[15-17] and presents the advantage of being a quick and easy instrument to use in the clinical setting. Even though it is a valid, reliable, and responsive questionnaire for young adults with hip pain,[18] the mHHS has limitations to assess physically active patients because of the small range of physical abilities assessed.[19] In 2006, the Hip Outcome Score (HOS)[20] was proposed to fill this gap, evaluating two subscales: Activities of Daily Living (ADL) and Sports. Since its development, a large number of studies have used HOS to assess young adults with hip disorders.[1,10-12,18]

In 2012, a new PROM was proposed to measure health-related quality of life in physically active patients with hip disorders: the International Hip Outcome Tool (iHOT-33).[21] This questionnaire has been extensively used since then and it contains four subscales: symptoms and functional limitations, sports and recreational activities, job-related concerns, and social, emotional, and lifestyle concerns.[21] Systematic reviews[12,18] have recommended the use of iHOT-33 as well as the Hip and Groin Outcome Score (HAGOS)[22] in the assessment of hip-related pain due to their adequate reliability and cross-cultural and construct validity. However, older questionnaires such as mHHS and HOS are still used by clinicians. Therefore, knowing the construct validity of these instruments and how they relate to each other is imperative.

Construct validity is defined by the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN)[23] as "the degree to which the scores of a measurement instrument are consistent with hypotheses, e.g. with regard to internal relationships, relationships with scores of other instruments or differences between relevant groups."[24] The similarity of results obtained with mHHS or HOS in relation to iHOT-33 in patients with FAI syndrome is so far unknown, as well as the association between their subscales. Therefore, the present study aimed to assess the construct validity of mHHS and HOS-ADL compared with iHOT-33 in a large sample of patients with FAI syndrome.

Methods

Study design

This retrospective study was conducted with data records from patients with FAI syndrome evaluated between 2013 and 2018 at a private physical therapy clinic (Porto Alegre, Brazil). The clinic's electronic database was accessed by the research team, and patients who completed the three questionnaires (mHHS, HOS-ADL and iHOT-33) during the initial physical therapy assessment were identified. The database contained the following variables: age, sex, height, weight, body mass index (BMI), and scores of the three questionnaires. This study was approved by the ethics committee of the Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Porto Alegre, RS, Brazil (#1.871.372).

Participants

Participants had been previously evaluated by an orthopedic surgeon and diagnosed with FAI syndrome based on the following criteria[25]: presence of motion-related or position-related pain at the hip; pain and limited range of motion with the flexion-adduction-internal rotation (FADIR) hip impingement test; and radiographical diagnosis of cam deformity and/or pincer morphology. Patients with a history of previous hip surgery, diabetes mellitus, or neuromuscular, neurological, or rheumatological diseases were excluded from the study. Patients who did not answer the three questionnaires at the physical therapy initial appointment were also not included in the study. All patients had signed an informed consent form agreeing with future use of data for research.

PROMs assessment

Participants were assessed using the translated and culturally adapted Brazilian version of the mHHS,[26] HOS-ADL,[27] and iHOT-33.[28] These PROMs were chosen for regular clinical use by the clinic's lead physical therapist in 2013. The mHHS and HOS were chosen due to their widespread use in the

assessment of hip disorders, while iHOT-33 was a new tool targeted to young active people with hip disorders. Only the participant and a physical therapist were present in the room during the assessments. Participants received standardized guidance on how to complete each instrument and the three questionnaires were provided in a single session. The order of application was the same for all participants: mHHS, HOS-ADL, and iHOT-33.

Regarding the psychometric properties, the iHOT-33 presents indeterminate structural validity, inadequate measurement error, and adequate reliability, responsiveness, construct validity, cross-cultural validity, and internal consistency.[12] The HOS-ADL has indeterminate structural validity and measurement error, but presents adequate reliability, responsiveness, construct validity, cross-cultural validity, and internal consistency.[12] The mHHS also presents good construct validity, test-retest reliability, responsiveness, and interpretability, but its floor and ceiling effects as well as agreement properties are inadequate, while its content validity and internal consistency are so far unknown.[18]

The maximum score (100 points), which represents the best possible result, is the same for the mHHS, HOS-ADL, and iHOT-33. The mHHS consists of two subscales, which evaluate pain (mHHS-Pain; 1 item) and function and activities of daily living (mHHS-Function; 7 items); pain scores a maximum of 44 points and function 47 points, and the multiplication by constant "1.1″ results in a possible total score of 100 points.[26] The HOS-ADL consists of 19 items scored from 0 ("unable to perform") to 4 ("no difficulty at all").[27] Assuming that a patient responds to all 19 items, the highest possible score is 76; thus, the total score obtained is divided by 76, and the resulting value is multiplied by 100 to express the score as a 0—100 scale.[29] The iHOT-33 consists of four subscales: 1) symptoms and functional limitations (iHOT-Symptoms; 16 items), 2) sports and recreational physical activity (iHOT-Sport; 6 items), 3) job-related concerns (iHOT-Job; 4 items), and 3) social, emotional, and lifestyle concerns (iHOT-Social; 7 items).[28] Each item can be answered from 0 to 100 points, and the final score is the sum of points divided by 33.[28]

Statistical analysis

Data normality was assessed using the Kolmogorov-Smirnov test. We conducted descriptive analyses to summarize the demographic characteristics of participants and the PROMs scores. The iHOT-33 was considered the reference instrument because it is widely used to assess young adults with hip pain.[12,18] The construct validity of the mHHS and HOS-ADL questionnaires was determined using hypothesis testing.

The primary hypotheses were the following: i) an acceptable agreement should be observed between the HOS-ADL score with the iHOT-33 score, as HOS-ADL score has been strongly correlated with the iHOT-12 score in people with hip pain[30]; ii) a non-acceptable agreement should be observed between the mHHS and iHOT-33 scores, because the mHSS was developed for older people undergoing hip arthroscopy and does not assess recreational or work activities.[14,27]

The secondary hypotheses were as follows: i) the mHHS score should present an acceptable agreement with the iHOT-Symptoms score, as the iHOT-Symptoms subscale assesses pain and function only; ii) the HOS-ADL score should present an acceptable agreement with the iHOT-Symptoms score, because the domains assessed by iHOT-Symptoms subscale are close to those assessed by the HOS-ADL[31,32]; iii) the mHHS and HOS-ADL scores should not present an acceptable agreement with iHOT-Sport, iHOT-Job, or iHOT-Social scores. For secondary hypotheses testing, each subscale of the iHOT-33 was normalized to express the score as a 0—100 scale.

Pearson's correlation coefficients were calculated. Correlation was considered to be negligible (r = 0.0—0.3), low (0.3—0.5), moderate (0.5—0.7), high (0.7—0.9), or very high (0.9—1.0).[33] As recommended by the COSMIN,[23] the level of agreement between instruments was considered acceptable if the correlations were greater than 0.70. Analyzes were done in R software (version 4.0).

Results

From the 523 patients with FAI syndrome identified in the clinic's database, 373 were eligible for this study. The participants' demographic characteristics are presented in Table 1, while the scores on the questionnaires are presented in Table 2. The mean mHHS scores were 29.3 points higher than iHOT-33 scores (95%CI: 27.9, 31.5), while the mean HOS-ADL scores were 30.3 points higher than iHOT-33 scores (95%CI: 29.0, 31.5).

The results of the primary hypotheses are presented in Table 3. A high correlation was found between the HOS-ADL and iHOT-33 scores, while a moderate correlation was found between mHHS and iHOT-33 scores. The results of the secondary hypotheses are presented in Table 4. The mHHS and HOS-ADL scores were moderately and highly correlated with the iHOT-Symptoms score, respectively. Both the mHHS and HOS-ADL scores were moderately correlated with the iHOT-Job and iHOT-Social scores. Both the mHHS and HOS-ADL scores were weakly correlated with the iHOT-Sport score.

Discussion

To the best of our knowledge, this is the first study assessing the construct validity of the mHSS and HOS-ADL compared

Table 1 Demographic characteristics of participants. Results presented as mean ± standard deviation (95% confidence interval).

	All (n = 373)	Male (n = 262)	Female (n = 111)
Age (years)	38 ± 11 (37, 39)	37 ± 11 (36, 39)	40 ± 10 (38, 42)
Height (cm)	173 ± 10 (172, 174)	177 ± 10 (176, 178)	165 ± 10 (164, 166)
Weight (kg)	76 ± 14 (75, 77)	81 ± 12 (79, 82)	64 ± 10 (62, 66)
BMI (kg/m^2)	25 ± 4 (25, 26)	26 ± 3 (25, 26)	23 ± 3 (23, 24)

BMI: body mass index.

Table 2 Scores of participants on the International Hip Outcome Tool (iHOT-33), the modified Harris Hip Score (mHHS), and the Hip Outcome Score - Activities of Daily Living (HOS-ADL). Results presented as mean ± standard deviation (95% confidence interval).

	All (*n* = 373)	Male (*n* = 262)	Female (*n* = 111)
iHOT-33 (0−100)	46.7 ± 19.5 (44.8, 48.7)	50.7 ± 18.8 (48.4, 53.0)	37.4 ± 18.0 (34.0, 40.7)
iHOT-Symptoms (0−1600)	884.7 ± 366.4 (847.6, 921.9)	958.3 ± 352.0 (915.6, 1000.9)	711.2 ± 341.6 (647.7, 774.8)
iHOT-Job (0−600)	184.3 ± 118.2 (130.5, 152.3)	205.6 ± 113.8 (191.8, 219.4)	133.9 ± 113.8 (112.8, 155.0)
iHOT-Sport (0−400)	141.4 ± 107.3 (130.5, 152.3)	151.6 ± 108.7 (138.4, 164.7)	117.2 ± 100.3 (98.9, 136.2)
iHOT-Social (0−700)	262.7 ± 156.0 (246.9, 278.5)	290.5 ± 154.8 (271.7, 309.2)	197.2 ± 138.8 (171.4, 223.0)
mHHS (0−100)	76.0 ± 13.5 (74.7, 77.4)	78.6 ± 12.9 (77.1, 80.2)	69.9 ± 13.1 (67.4, 72.3)
mHHS-Pain (0−44)	27.8 ± 8.1 (26.9, 28.6)	29.0 ± 8.1 (28.0, 30.0)	24.8 ± 7.5 (23.4, 26.2)
mHHS-Function (0−47)	41.4 ± 5.7 (40.8, 41.9)	42.5 ± 5.2 (41.9, 43.1)	38.7 ± 5.9 (37.6, 39.8)
HOS-ADL (0−100)	77.0 ± 16.3 (75.3, 78.6)	80.3 ± 14.3 (78.6, 82.0)	69.2 ± 18.0 (65.8, 72.5)

Table 3 Results of the primary hypothesis testing.

	Pearson's correlation (95% CI)	p-value
mHHS vs. iHOT-33	0.68 (0.62, 0.73)	$p<0.001$
HOS-ADL vs. iHOT-33	0.78 (0.73, 0.81)	$p<0.001$

CI: confidence interval; HOS-ADL: Hip Outcome Score - Activities of Daily Living; iHOT-33: International Hip Outcome Tool; mHHS: modified Harris Hip Score.

to the iHOT-33 in patients with FAI syndrome. The main findings of the present study were: (1) an acceptable agreement was found between HOS-ADL and iHOT-33, but not between mHHS and iHOT-33; (2) HOS-ADL score presented an acceptable agreement with iHOT-Symptoms score, while mHHS score did not; (3) neither HOS-ADL nor mHHS presented an acceptable agreement with the iHOT-Sport, iHOT-Job, and iHOT-Social scores.

As initially hypothesized, the HOS-ADL and iHOT-33 scores were highly correlated. The HOS-ADL questionnaire assesses activities of daily living, while the iHOT-33 evaluates pain, functional limitation, sports and recreational physical activity, and job-related, social, emotional, and lifestyle concerns. A large number of common domains could explain patients presenting similar scores in both PROMs. However, because the iHOT-33 has

Table 4 Results of secondary hypothesis testing.

		Pearson's correlation (95% CI)	p-value
mHHS	*vs.* iHOT-Symptoms	0.68 (0.62, 0.73)	$p<0.001$
	vs. iHOT-Sport	0.38 (0.29, 0.46)	$p<0.001$
	vs. iHOT-Job	0.53 (0.46, 0.60)	$p<0.001$
	vs. iHOT-Social	0.52 (0.45, 0.59)	$p<0.001$
HOS-ADL	*vs.* iHOT-Symptoms	0.77 (0.73, 0.81)	$p<0.001$
	vs. iHOT-Sport	0.47 (0.39, 0.54)	$p<0.001$
	vs. iHOT-Job	0.63 (0.57, 0.69)	$p<0.001$
	vs. iHOT-Social	0.53 (0.46, 0.60)	$p<0.001$

CI: confidence interval; HOS-ADL: Hip Outcome Score - Activities of Daily Living; iHOT-33: International Hip Outcome Tool; mHHS: modified Harris Hip Score.

additional domains, such as emotional and lifestyle concerns, a higher correlation should be expected when comparing only the iHOT-Symptons subscale with the HOS-ADL. Nonetheless, HOS-ADL presented a similar correlation with both the iHOT-33 score (r = 0.78, 95%CI: 0.73, 0.81) and iHOT-Symptoms score (r = 0.77, 95%CI: 0.73, 0.81), supporting an acceptable agreement of the HOS-ADL with both iHOT-33 and iHOT-Symptoms.

The hypothesis that the mHHS score would not present an acceptable agreement with the iHOT-33 score was confirmed, despite the correlation value being close to the 0.70 cutoff point (r = 0.68, 95%CI: 0.62, 0.73). Even though both questionnaires measure pain and function, the questions are slightly different. Patients quantify how difficult it is to perform a certain activity in the iHOT-Symptoms subscale questions, while they report the limitations in performing simple daily activities such as sitting or walking in the mHHS. It is important to note that the mHHS was developed for older people undergoing hip arthroscopy[14] and for assessing pain, function, and activities of daily living, but not recreational or work activities. This could explain the moderate correlation found between the mHHS and the iHOT-33 scores. Furthermore, different from the other PROMs, the pain subscale represents almost half of the mHHS score. A previous study has shown a high correlation between the mHHS score and the visual analogue scale for pain in people with hip dysplasia,[34] further supporting the high contribution of pain for the mHHS score. Thus, we expected to find a higher correlation between the mHHS and iHOT-Symtpoms scores in our secondary hypothesis testing, but this hypothesis was refuted.

Our results confirmed the hypothesis that the mHHS and HOS-ADL scores do not have acceptable agreement levels with iHOT-Sport, iHOT-Job, and iHOT-Social scores because mHHS and HOS-ADL scores do not specifically assess sports, work, and social domains as iHOT-33 subscales do. Moreover, psychosocial factors are weakly associated with pain in patients with various lower limb pain conditions.[35,36] Nonetheless, previous studies have found that patients with FAI syndrome present pain catastrophizing, high levels of anxiety, depression, and insomnia.[37,38] This indicates that FAI syndrome negatively impacts patients' psychosocial status, which may further influence patients' outcomes and lead to lower iHOT-33 scores.

The lower scores obtained with the iHOT-33 (~30 points) may give the impression that the FAI syndrome causes a greater burden to a patient than when considering the mHHS or HOS scores. However, patients with FAI syndrome have shown increments of ~9 points in the mHSS and HOS in response to non-surgical treatment,[11,39] while the improvement in iHOT-33 score was of ~14 points[9] (note that the minimal clinically important difference for mHSS, HOS, and iHOT-33 are ~8, ~9, and ~6 points, respectively[40,41]). In other words, despite the lower baseline scores, there is a greater score change in response to treatment when patients are assessed with iHOT-33 compared to the other two questionnaires.

The present study has some limitations. First, a portion of the participants' records did not present details of the FAI type (cam, pincer, or mixed). Therefore, it was not possible to carry out specific analyzes with these subgroups. Second, we did not have standardized information on participants' education level, lifestyle, and/or physical activity level, symptoms duration, time since FAI syndrome diagnosis, and co-morbidities which would allow further characterization of the population and subgroup analyses. Third, we did not apply the HOS sport participation subscale because our sample did not have an athletic profile, but it is reasonable to expect an acceptable agreement of this HOS subscale with the iHOT-Sport in patients engaged in sport activities. Fourth, despite the HAGOS having been recommended by recent evidence,[12] the Brazilian version of this questionnaire was validated only in 2019[42] and, therefore, it was not part of the assessment routine when data were collected. The strengths of our study include a large sample size, the methodological rigor adopted in the assessment of participants, and the data analysis following the COSMIN[23] recommendations.

Conclusion

The mHHS score presented non-acceptable agreement with iHOT-33 score or any of its subscales, thus mHHS is not recommended to be used in patients with FAI syndrome. Conversely, the HOS-ADL score presented an acceptable agreement with the iHOT-33 and iHOT-Symptoms scores, suggesting HOS-ADL as a valid PROM for FAI syndrome. However, clinicians should expect considerably higher scores (~30 points of difference) when patients are assessed with the HOS-ADL instead of iHOT-33.

Conflict of interest

The authors declare no conflicts of interest.

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