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Original Article

Clinical assessment after total hip arthroplasty using the Japanese Orthopaedic Association Hip-Disease Evaluation Questionnaire

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ABSTRACT

Aims: The aim of this study was to evaluate clinical outcomes using the Japanese Orthopaedic Association Hip-Disease Evaluation Questionnaire (JHEQ).

Methods: 100 consecutive patients at 6 months after total hip arthroplasty (THA) were evaluated.

Results: The improvement rate for the pain subscale was significantly higher than that for the movement and mental subscales. Preoperative scores on the JHEQ movement and mental subscales were positively correlated to scores on the same subscales at 6 months after surgery.

Conclusion: We conclude that the most predictable aspect of THA is pain relief and preoperative hip-joint ROM and mental status influence 6-month postoperative outcomes.

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1. Introduction

Total hip arthroplasty (THA) has revolutionized the treatment of osteoarthritis (OA) of the hip.^{1,2} The Harris hip score³ and Merle d'Aubigné and Postel score⁴ are generally used by physicians to evaluate the hip joint. Recently, there has been heightened interest in evaluating patients' quality of life (QOL) after THA. The World Health Organization defines QOL as including physical, material, social, and emotional well-being, as well as individual development and participation in daily

activity.⁵ To evaluate the outcomes of THA, self-descriptive QOL scores such as the Short Form-36 (SF-36),⁶ the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC),⁷ and the Oxford hip score (OHS)^{8,9} have been used. In Japan, the Japanese Orthopaedic Association hip score has been widely used as a method to assess hip-joint diseases.¹⁰ The problem with evaluations that are based on the perspective of the physician is that the physician's subjective impressions affect the evaluation and may differ markedly from the patient's experience. Also, there may be a large degree of interobserver error.^{11,12} The recently developed

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Japanese Orthopaedic Association Hip-Disease Evaluation Questionnaire (JHEQ) includes questions related to common Asian-lifestyle movements, such as using a squatting pan toilet or getting up from the floor. Matsumoto et al¹³ suggested that because the JHEQ takes into account such movements, it would improve the assessment of QOL for Asian patients. At the same time, the JHEQ can be useful in Western populations for evaluating patients who frequently engage in deep flexion of the hip joint. The JHEQ also makes possible preoperative and postoperative evaluation of factors that formerly were not assessed. Seki and Hasegawa et al reported that the JHEQ is a reliable and valid tool for evaluating hip disease.¹⁴ Until now, to our knowledge, there have been no reports on clinical evaluation after THA using the JHEQ. We therefore conducted a study using the JHEQ to assess postoperative clinical outcomes at 6 months after THA.

2. Materials and methods

All patients who underwent primary unilateral THA at our institution between May 2011 and May 2012 were eligible for participation in our study. We evaluated a total of 100 consecutive primary patients: 90 women and 10 men. The average age of patients at surgery was 61.6 years (range, 42–82 years). Population characteristics are shown in Table 1.

We evaluated all patients using the JHEQ, including Charnley's functional categories (A, B, and C),^{15,16} when we decided to perform THAs for the patients at our outpatient clinic, and then reevaluated them 6 months after surgery. The questionnaires were filled out by the patients themselves while they waited in the outpatient clinic and were then collected by the person in charge or were directly returned by the patients.

All THAs were performed using a posterolateral approach with the patient in the lateral position. Trilogy acetabular cups

(Zimmer, Warsaw, IN, USA) with multiple screw holes were inserted and fixed with 2 or 3 screws in all patients. All acetabular components were inserted after being reamed to the same size; 26-, 28-, or 32-mm femoral heads were used, but a much bigger size was selected if the polyethylene was >7 mm thick. Patients received an APS (Zimmer), Kinectiv (Zimmer), S-ROM-A (DePuy, Warsaw, IN, USA), or Modulus (Lima, Udine, Italy) cementless stem or an SC (JMM, Osaka, Japan) or Exeter (Stryker, Kalamazoo, MI, USA) cemented stem. These implants were not randomly inserted but were chosen according to the condition of the femoral bone stock. The wound was drained in each case. All patients received intravenous antibiotics and underwent routine postoperative rehabilitation.

The JHEQ consists of pain (28 points), movement (28 points), and mental (28 points) subscales, with higher scores indicating a better outcome.³ First, dissatisfaction with the patient's current condition and hip-joint pain on each side are marked on a visual analog scale (VAS) of 0 mm (complete satisfaction or no pain at all) to 100 mm (complete dissatisfaction or maximum pain). The VAS for hip-joint pain is converted to 0 to 4 points (4, VAS 0–20 mm; 3, 21–40 mm; 2, 41–60 mm; 1, 61–80 mm; 0, 81–100 mm). Next, questions for each of the pain, movement, and mental subscales are completed, with possible scores for each item ranging from 0 to 4 (0, strongly agree; 1, agree; 2, uncertain; 3, disagree; 4, strongly disagree). The maximum total score for all subscales combined is 84 points. For questions that are answered separately for the left versus right hip joint, the following criteria were used to determine the laterality to be used for analysis:

- Criterion 1: Use the side that has problems caused by the hip-joint condition.
- Criterion 2: If both sides have problems caused by the hip-joint condition, use the score on the side that has greater pain.
- Criterion 3: If laterality cannot be decided with either criterion 1 or 2, use the side that has lower scores for each item.

We assessed the following parameters

- Clinical outcomes before surgery, using the JHEQ
- Clinical outcomes 6 months after surgery, using the JHEQ
- The correlation between the improvement rate
 - On each subscale (pain, movement, and mental)
 - On the 100-mm VAS
 - On each parameter (the pain, movement, and mental subscales)

Statistical analyses were performed for the differences between subscales using the unpaired Student's *t*-test, and *p* values of <0.05 were considered significant. A simple linear regression analysis was used for detecting correlations between improvements in scores on the 100-mm VAS at 6 months after THA and on each parameter (the pain, movement, and mental subscales) at 6 months after THA, and between preoperative and postoperative scores on each subscale. Also, multiple linear regression analysis was carried

Table 1 – Demographic characteristics.

Characteristic	No. of patients
No. of hips	100
Sex (male:female)	10:90
Mean height (cm)	154.3 (range, 133–185)
Mean weight (kg)	56.2 (range, 30–94)
Body mass index (kg/m ²)	23.5 (SD, ±3.42)
Charnley category	
A	62
B	37
C	1
Etiology	
DDH	92
ONF	8
Stem fixation	
Cemented	25
Cementless	75
Femoral head size	
26 mm	9
28 mm	79
32 mm	12

DDH: developmental dysplasia of the hip; ONF: osteonecrosis of the femoral head.

out to determine related variables for preoperative and postoperative satisfaction (100-mm VAS):

- Each subscale
- Age at surgery
- Gender
- The presence of medical complications:
 - Diabetes mellitus
 - Hypertension
 - Heart disease
- Body mass index (BMI)
- Use of cemented versus noncemented stem

All statistical analyses were performed using SPSS statistical software (IBM, Armonk, NY, USA).

3. Results

No patients in the study group had infections, dislocations, intraoperative fractures, or deep vein thrombosis.

The mean total JHEQ score improved significantly, from 25.9 (30.8%) points preoperatively to 59.1 points (70.4%) postoperatively ($p < 0.001$). Also, scores on each subscale (pain, movement, and mental) had significantly improved ($p < 0.001$) by the 6 month follow-up evaluation. Equations for calculating the improvement rate for each subscale and the improvement rate for satisfaction are shown in Fig. 1. The improvement rate for satisfaction was 85.6% at 6 months after THA.

The improvement rate for the pain subscale was significantly higher than that for the movement and mental

subscales (Fig. 2). We found that the postoperative JHEQ pain subscale showed a stronger correlation to the 100-mm VAS (satisfaction) at 6 months after surgery compared with the movement and mental subscales. Preoperative satisfaction was related to the preoperative JHEQ pain subscale. Postoperative satisfaction was related to all 3 postoperative subscales; in particular, the pain subscale had the strongest correlation to postoperative satisfaction (Table 2). Furthermore, the improvement rate for the pain subscale showed the strongest correlation among the 3 subscales to the improvement rate for satisfaction (Table 3).

Positive correlations were seen between preoperative total JHEQ scores and total JHEQ scores at 6 months after surgery. Similarly, preoperative scores on the JHEQ movement and mental subscales were positively correlated to scores on the JHEQ movement and mental subscales at 6 months after surgery (correlation coefficient, 0.369 and 0.438; $p < 0.001$). In contrast to the movement and mental subscales, there was no significant correlation (correlation coefficient, 0.165; $p = 0.101$) between the preoperative and postoperative pain subscales (Table 4). A multiple regression analysis revealed that the preoperative pain subscale and BMI were related factors for preoperative satisfaction: The lower the preoperative pain subscale score or the higher BMI patients have, the lower their preoperative satisfaction will be. Analysis also revealed that scores on the postoperative pain and mental subscales and using a cemented stem were related factors for postoperative satisfaction: the higher the scores on the postoperative pain and mental subscales that patients have, or if a cemented stem is used, the higher their postoperative satisfaction will be (Table 5). We determined the internal consistency of the JHEQ as an index for reliability, and found high values for

Fig. 1 – Preoperative and postoperative average scores on the Japanese Orthopaedic Association Hip-Disease Evaluation Questionnaire. THA = total hip arthroplasty, VAS = visual analog scale.

Fig. 2 – Improvement rates for each subscale and for satisfaction. The subscale rate showing the most improvement after total hip arthroplasty was the pain subscale.

Cronbach α coefficient (0.9) for each of the JHEQ subscales (Table 6).

4. Discussion

This is the first report to evaluate clinical outcomes after THAs using the JHEQ, a newly developed patient-based QOL evaluation. Our outcomes demonstrated that the parameter for which there was most improvement at 6 months after THA was relief from hip-joint pain. Also, preoperative range of motion (ROM) was significantly correlated with postoperative ROM, just as preoperative mental status was significantly

correlated with postoperative mental status. Various items in the JHEQ concern lifestyle activities that require deep flexion of the hip joint, such as getting up from the floor or squatting. In comparison, WOMAC, the OHS, and the SF-36 lack items that directly assess deep flexion of the hip joint. It has been reported to be difficult to assess appropriately any decrease in activities of daily living due to a limited ROM using the OHS in cultures that require deep flexion of the hip joint.¹⁷ Therefore, the JHEQ is suitable for populations leading an Asian lifestyle, and it is also useful in Western populations where deep flexion movements are required in activities of daily living.

Our findings indicate that the optimal effect of THA for patients with hip disease is a decrease in pain, because the improvement rate for the JHEQ pain subscale was higher than the rate for the movement or mental subscales, and the improvement rate for satisfaction had the strongest correlation with the improvement rate of the pain subscale of all of the 3 subscales. The relationship between the improvement rate for satisfaction and the improvement rate for the pain subscale also bolsters the finding that the most important

Table 2 – Comparison between preoperative or postoperative VAS score and preoperative or postoperative score for each subscale.

Scale or subscale	Pearson correlation coefficient
Preoperative VAS (mm)	
Total JHEQ score	–0.306**
Pain subscale	–0.322***
Movement subscale	–0.231
Mental subscale	–0.162
Postoperative VAS (mm)	
Total JHEQ score	–0.557***
Pain subscale	–0.580***
Movement subscale	–0.411***
Mental subscale	–0.439***

Significant differences: **P < 0.01; ***P < 0.001.

JHEQ: Japanese Orthopaedic Association Hip-Disease Evaluation Questionnaire; VAS: visual analog scale.

Table 3 – Comparison between improvement rate for satisfaction and improvement rate for each subscale.

Subscale being compared	Pearson correlation coefficient
Improvement rate for satisfaction	
Pain subscale	0.550***
Movement subscale	0.323**
Mental subscale	0.348***

Significant differences: **P < 0.01; ***P < 0.001.

Table 4 – Comparison between scale scores at baseline and at 6 months after THA.

Subscale being compared	Pearson's correlation coefficient 6 months after THA				
	Total JHEQ score	Pain subscale	Movement subscale	Mental subscale	VAS (mm)
Preoperative					
Total JHEQ score	0.338***	0.219	0.279	0.320	0.239
Pain subscale	0.071	0.165	0.025	0.027	–0.213
Movement subscale	0.312**	0.124	0.369***	0.235	–0.182
Mental subscale	0.379***	0.201	0.262	0.438***	–0.157
VAS (mm)	0.011	0.054	–0.004	–0.054	0.047

Significant differences: **P < 0.01; ***P < 0.001.
JHEQ: Japanese Orthopaedic Association Hip-Disease Evaluation Questionnaire; THA: total hip arthroplasty; VAS: visual analog scale.

Table 5 – Multiple linear regression analysis of preoperative and postoperative satisfaction.

Satisfaction parameters	Estimate	SE	P value
Preoperative satisfaction			
Intercept	68.490	10.929	<0.001
Preoperative pain subscale	–1.012	0.292	0.001
Body mass index	1.004	0.450	0.028
			R ² = 0.148
Postoperative satisfaction			
Intercept	54.791	6.439	<0.001
Postoperative pain subscale	–1.510	0.300	<0.001
Postoperative mental subscale	–0.451	0.187	0.018
Using a cemented stem	–3.43	1.247	0.007
			R ² = 0.413

SE: standard error.

factor for satisfaction after THA is relief from hip-joint pain. In general, it is said that of all orthopedic surgical procedures, THA is one that can produce a high level of patient satisfaction. Our findings demonstrate why this is the case. Multiple regression analysis showed that the preoperative pain subscale and BMI are related to preoperative satisfaction, which is consistent with our clinical experience.

We found the use of a cemented stem to be a factor related to postoperative satisfaction. We performed additional analysis in an attempt to determine why cemented stems produced better satisfaction by 6 months after surgery than cementless stems. Unfortunately, however, we could not pinpoint the reasons. Although we speculate that one reason may be that cementless stems require a couple of months for the achievement of bone ingrowth fixation but that cemented stems do not, we must investigate further.

Matsumoto et al¹³ reported Cronbach α coefficients of 0.95, 0.93, and 0.93 for the pain, movement, and mental subscales, respectively. Similarly, Seki et al¹⁴ reported Cronbach α

coefficients of 0.92, 0.91, and 0.94 for each subscale. We obtained similar results, with coefficients of 0.96, 0.90, and 0.95 for the pain, movement, and mental subscales, respectively, verifying high internal consistency, which is one of the indicators of reliability. Fortin et al suggested that surgery performed later in the natural history of functional decline due to OA of the hip results in worse postoperative functional status.¹⁸ We obtained similar results: The lower the preoperative total JHEQ score is, the lower the postoperative JHEQ score tends to be (Table 4). Fortin et al also suggested that the best predictors of pain and function at 6 months after THA are the patient's baseline pain and function. However, our findings differed somewhat, indicating that the best predictors among the JHEQ subscales at 6 months after THA were baseline scores not on the pain and movement subscales but instead on the movement and mental subscales (Table 3). Although it is unknown why pain was not a single predictor at 6 months after THA in our study, our outcomes would seem to indicate that patients who have severe preoperative pain do not always tend to report more pain at 6 months after surgery, compared with patients who have milder preoperative pain. In addition, our data indicate that there was a tendency for patients with a limited ROM or with mental problems before surgery to have persistently limited ROM or persistent mental problems even at 6 months after THA. Hip surgeons aim to address clinical decision-making not only on the basis of physical and radiological findings but also within the context of QOL: For example, an operation can be delayed until any attendant psychological or social concerns are addressed, just as it can be scheduled for an earlier date, before a patient's ROM becomes severely limited. Therefore, we suggest that our results are useful for hip surgeons in planning surgery and in providing patients with a preoperative explanation of what to expect from THA.

Our study has some limitations. First, we studied only Japanese patients. Second, the number of patients that we

Table 6 – Cronbach's α coefficients for each subscale of the JHEQ.

	Cronbach's α coefficient		
	Preoperative	6 months after THA	Preoperative + postoperative
Pain subscale	0.864	0.904	0.963
Movement subscale	0.783	0.894	0.902
Mental subscale	0.913	0.931	0.949

JHEQ: Japanese Orthopaedic Association Hip-Disease Evaluation Questionnaire; THA: total hip arthroplasty.

evaluated was relatively small, which might have affected our conclusions. Third, we evaluated outcomes only at 6 months after the surgery, so it is possible that outcomes might change by 1 year or more. Fourth, our study was limited by the involvement of only one center. We recognize that there may be considerable variation in clinical practices and patient characteristics within Japan. Thus, further investigation is needed that involves a longer follow-up period and multiple centers worldwide.

Our study concludes that evaluation of clinical outcomes of THA using the JHEQ, a newly developed patient-based assessment tool, shows that the most predictable aspect of THA is pain relief, regardless of the severity of preoperative pain. Preoperative hip-joint ROM and mental status influence 6-month postoperative outcomes, so it is important to take into consideration both of those aspects when planning THA.

Disclosure

Each author certifies that he has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article. Each author certifies that his institution approved the reporting of this case and that all investigations were conducted in conformity with ethical principles of research.

Conflicts of interest

All authors have none to declare.

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