Responsiveness of the Korean Version of the Michigan Hand Outcomes Questionnaire after Carpal Tunnel Release

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Background: The Korean version of the Michigan Hand Outcomes Questionnaire (K-MHQ) was recently validated; however, the questionnaire's responsiveness as well as the degree to which the instrument is sensitive to change has not been thoroughly evaluated in a specific condition in Koreans. We evaluated the responsiveness of the K-MHQ in a homogenous cohort of patients with carpal tunnel syndrome (CTS) and we compared it with that of the Korean version of the Disability of the Arm, Shoulder, and Hand Questionnaire (K-DASH), which was found to have a large degree of responsiveness after carpal tunnel release for Korean patients with CTS.

Methods: Thirty-seven patients with CTS prospectively completed the K-MHQ and the K-DASH before and 6 months after surgery. The responsiveness statistics were assessed for both the K-MHQ and the K-DASH by using the standardized response mean (SRM), which was defined as the mean change of the original scores after surgery divided by the standard deviation of the change.

Results: All domains of the K-MHQ significantly improved after carpal tunnel release ($p < 0.001$). The SRM for all scales but one (the aesthetics scale) showed large responsiveness of ≥ 0.8. The aesthetics scale showed medium responsiveness of 0.6. The combined function/symptom scale of the K-DASH significantly improved after surgery ($p < 0.001$). The SRM of the K-DASH revealed large responsiveness of 0.9.

Conclusions: The K-MHQ was found to have a large degree of responsiveness after carpal tunnel release for Korean patients with CTS, which is comparable not only to the K-DASH, but also to the original version of the MHQ. The region-specific K-MHQ can be useful for outcomes research related to carpal tunnel surgery, especially for research comparing CTS with various other hand and wrist health conditions.

Keywords: *Responsiveness, K-MHQ, K-DASH, Carpal tunnel syndrome*

Health and functional status questionnaires have been increasingly used to assess the effectiveness of medical treatment or surgery. In hand surgery, physicians have used these instruments to evaluate patient outcomes for specific hand conditions such as carpal tunnel syndrome (CTS), distal radius fracture, and rheumatoid arthritis.[1,2]

The Michigan Hand Outcomes Questionnaire (MHQ) is one of the most widely used hand-specific surveys that measures health status relevant to patients with hand disorders.[3] The MHQ assesses the patient's perception for six different scales, including function, activities, pain, work, satisfaction, and asthetics.[4] The validity, reliability, and responsiveness of the MHQ have been

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reported for a variety of upper extremity conditions such as CTS, distal radius fracture, and rheumatoid arthritis.[5-7] The MHQ has also been translated into Korean: the validity and reliability of the Korean version of MHQ (K-MHQ) were recently assessed for arm, shoulder, and hand musculoskeletal conditions.[8] However, the responsiveness of K-MHQ, and the degree to which the instrument is sensitive to change, has not been thoroughly evaluated for a specific medical condition in Koreans.

CTS is the most common compressive neuropathy in the upper extremity.[9] The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire is a well-known and frequently used tool that was developed for the assessment of patients with upper extremity conditions. The Korean version of DASH (K-DASH) has been validated for the assessment of upper extremity conditions; it was also found to be responsive to carpal tunnel release.[10,11] The purpose of this study was to evaluate the responsiveness of the K-MHQ to carpel tunnel release, and to compare the results with those of the K-DASH in a homogenous cohort of patients with CTS.

METHODS

Subjects

Eighty-four consecutive patients with CTS scheduled for surgery at our institution (an urban tertiary referral hospital) were prospectively recruited for the study between June 2011 and February 2012. All patients were referred by primary care physicians, general orthopaedic surgeons, neurologists, or rehabilitation physicians. We excluded those from the study with any other upper extremity problem besides CTS, such as a history of forearm fracture or malunion, cervical radiculopathy, and cubital tunnel syndrome. We also excluded those from the study with systemic comorbidities, such as rheumatoid arthritis, diabetes mellitus, thyroid disease, and chronic renal failure. Concurrent disorders and loss of follow-up led to a total of forty-seven patients being excluded from the final data analysis. Therefore, data analysis was performed for the remaining thirty-seven patients. The patients included consisted of 1 man and 36 women; their ages ranged from 28 years old to 73 years old (average, 53.5 years old). This study was approved by the Institutional Review Board of the authors' hospital; informed consent was obtained from all patients.

CTS was diagnosed based on clinical symptoms, such as tingling sensation of the hand. Electrophysiologic studies were conducted for all patients to confirm the diagnosis; only those with positive findings were included for analysis. We used the classification developed by Bland[12]: the classification consists of 7 grades from grade 0 (normal) to grade 6 (extremely severe) based on conduction time and amplitude. All patients underwent either unilateral or simultaneous bilateral open carpal tunnel release by a single surgeon (HSG) under local anesthesia.

K-MHQ and K-DASH

Evaluations using the K-MHQ and K-DASH were performed preoperatively and six months postoperatively. The six-month interval period was chosen due to findings from a previous study: the study found that patients who have carpal tunnel release tend to plateau in functional and symptom improvement six months after surgery when assessed via questionnaire.[13]

The K-MHQ is a 57-item hand-specific outcomes questionnaire that contains 6 domains: (1) function, (2) activities of daily living, (3) pain, (4) work performance, (5) aesthetics, and (6) patient satisfaction. Patients are asked to answer each question for the relevant domain using a scale of 1 to 5. Each domain is assessed on a score from 0 to 100. All scales except for work and pain assess each hand separately and are scored according to the affected hand or as an average for bilaterally affected hands. There is no scoring adjustment for hand dominance. The K-MHQ was translated by two of the authors (HSG and YHR), approved by the original developer (Kevin Chung, University of Michigan, USA), and was validated for its reliability and cross-cultural adaptation for common hand disorders. The instrument is presented in the Appendix 1.[8]

The K-DASH questionnaire primarily consists of a 30 item scale concerning the patient's health status for the preceding week. The items ask about the following issues: degree of difficulty in performing various physical activities because of an arm; shoulder or hand problem (21 items); the severity of each symptom of pain, activity-related pain, tingling, weakness, and stiffness (5 items); the problem's effect on social activities, work and sleep; and its psychological impact (4 items). Each item has five response options, ranging from 1 to 5. If at least 27 of the 30 items are completed, then a score ranging from 0 (no disability) to 100 (the most severe disability) can be calculated. The two optional scales of K-DASH (sport/music and work) were excluded from this study.

Data Analysis

Statistical analysis was performed using IBM SPSS ver. 19.0 (IBM Co., Armonk, NY, USA). Paired t-tests were used when comparing the preoperative versus postoperative scores. Two-sample Student t-tests were performed

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when comparing scores for patients who had unilateral carpal tunnel release versus patients who had simultaneous bilateral carpal tunnel release and comparing scores for the mild (Bland grade 1–2) group versus moderate to severe (Bland grade 3–5) group. The level of significance chosen for the analysis was $p = 0.05$.

The responsiveness of each questionnaire was evaluated in this study using a distribution-based methodology: This was performed by calculating the standardized response mean (SRM).[14] The SRM was defined as the mean change between pre- and postoperative scores divided by the standard deviation of the total change. The higher the SRM, the greater the level of responsiveness is. Values ≤ 0.5, between 0.5 and 0.8, and ≥ 0.8 were considered to represent small, moderate, and large degrees of responsiveness, respectively.[15]

For the sample size calculation, we needed a total of 56 patients to achieve 90% power. We initially recruited 84 patients for this study. However, due to concurrent disorders and a loss of follow-up, data analysis was performed for only 37 patients. However, as the study results were positive, retrospective power analysis indicated that the statistical power was adequate.

RESULTS

Comparison of Pre- and Postoperative Scores
All domains of the K-MHQ (function, activities of daily living, work, pain, aesthetics, and satisfaction) revealed significant postoperative improvement ($p < 0.001$) (Table

1). Comparing the unilateral and bilateral surgery group, there were no statistically significant differences preoperatively and postoperatively in mean function scores ($p = 0.71$ and 0.53, respectively), and in mean pain scores ($p = 0.85$ and 0.96, respectively). Comparing the mild (Bland grade 1–2) and moderate to severe (Bland grade 3–5) group, there were no significant differences in mean preoperative and postoperative K-MHQ scores (function: $p = 0.33$ and 0.51; pain: $p = 0.59$ and 0.25, respectively).

K-DASH scores decreased by 19 points, revealing a significant postoperative improvement ($p < 0.001$) (Table 2). There were no significant differences between unilateral and bilateral patients in mean preoperative and postoperative K-DASH scores ($p = 0.82$ and 0.54, respectively). There were no significant differences between mild and moderate to severe group in mean preoperative or postoperative K-DASH scores, either ($p = 0.22$ and 0.35, respectively).

Responsiveness of Outcome Scores
The SRM for the K-MHQ ranged from medium (0.6) for the aesthetics scales, to large (0.8–1.0) for the pain, satisfaction, activities of daily living, work, and function scales. For patients who had unilateral surgery, the SRMs for the work and pain scales were 0.8 and 0.9, respectively. For patients who had bilateral surgery. the SRMs for the work and pain scales were 1.0 and 1.1, respectively.

The SRM for K-DASH was 0.9. For patients who had unilateral surgery, the SRM for the K-DASH was 0.8. For patients who had bilateral surgery, the SRM for the K-DASH was 1.1.

DISCUSSION

In this study, we evaluated the responsiveness of the K-MHQ for CTS and compared it with that of the K-DASH. We found that the K-MHQ had a level of responsiveness similar to that of the K-DASH in the assessment of CTS outcomes.

Table 1. Preoperative vs. 6-month Postoperative K-MHQ Scores

Scale*	Preoperative	Postoperative	p-value	SRM[†]
Function	47.1 ± 18.0	69.1 ± 18.8	< 0.001	1.0
Activities of daily living	59.7 ± 19.7	80.4 ± 16.2	< 0.001	0.9
Work	42.0 ± 18.7	67.8 ± 19.1	< 0.001	0.9
Pain	67.8 ± 22.6	45.4 ± 14.3	< 0.001	0.9
Aesthetics	71.1 ± 22.6	52.8 ± 19.9	< 0.001	0.6
Satisfaction	51.1 ± 24.0	78.1 ± 25.7	< 0.001	0.8

Values are presented as mean ± SD.
K-MHQ: Korean version of the Michigan Hand Outcomes Questionnaire, SRM: standardized response mean.
*All of the K-MHQ scales are based on a score from 0 to 100. For all of the scales except pain, a higher score translates into better performance for the patient's hand. For the pain scale, the relationship is inverse: the lower the score, the less pain the patient experiences, which signifies a better outcome.
[†]Mean difference between preoperative and postoperative scores/standard deviation of mean difference. An SRM of 0.2 is considered small, 0.5 is considered medium, and 0.8 is considered large.

Table 2. Preoperative vs. 6-month Postoperative Scores of the K-DASH Questionnaire

Scale*	Preoperative	Postoperative	p-value	SRM
Function/symptom	39.6 ± 17.4	20.2 ± 15.8	< 0.001	0.9

Values are presented as mean ± SD.
K-DASH: Korean version of the Disability of the Arm, Shoulder, and Hand Questionnaire, SRM: standardized response mean.
*The K-DASH is based on a score from 0 to 100. A lower score indicates less disability.

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Table 3. The Responsiveness of Various Studies of the MHQ after Carpal Tunnel Release

Scale	Standardized response mean		
	Chatterjee and Price[7]	Kotsis and Chung[16]	Present study
Function	0.8	0.6	1.0
Activities of daily living	0.8	0.5	0.9
Work	0.8	0.5	0.9
Pain	1.3	0.9	0.9
Aesthetics	0.8	Not reported	0.6
Satisfaction	0.8	1.1	0.8

MHQ: Michigan Hand Outcomes Questionnaire.

Several previous studies have evaluated the responsiveness of the MHQ for CTS patients. Kotsis and Chung[16] reported that the SRM varied from 0.5 to 0.6 for the activity subscale and from 0.9 to 1.1 for the pain and satisfaction scales. The study by Chatterjee and Price[7] showed the SRM varied from 0.78 to 1.30 for the pain, aesthetics, and function scales and from 0.79 to 0.80 for the satisfaction, activity, and work scales (Table 3). Compared with these studies, the K-MHQ was found to have a sufficient degree of responsiveness for assessing and comparing outcomes for Korean patients with CTS.

Previous studies found that the pain domain seemed to be the most responsive for the MHQ, but as shown in Table 3, our study found that the function domain appeared to be the most responsive. The reason for this difference is presumed that the high proportion (83.8%) of moderate to severe patients (Bland grade 3–5) who had a sensory or motor deficit would experience comprehensive improvement in hand functioning.

The aesthetics domain may not be pertinent to carpal tunnel release.[17] In addition, aesthetics outcomes may worsen because of the scar after open carpal tunnel release. In this study, however, there was a significant improvement in the aesthetic domain after surgery, which concurs with previous study by the Chatterjee and Price.[7] They suggested that patients may have improved their self-image secondary to better function following carpal tunnel release and their perception of their hand aesthetics therefore improved.

In the present study, we compared scores between

the K-DASH and-MHQ. The K-DASH is a more general questionnaire with questions that assess the collective arm, shoulder, and hand conditions. The combined function/symptom scale of the K-DASH limits the measurement of symptom and function improvement after carpal tunnel surgery because symptoms are quicker to improve than functional outcomes.[18-21] Furthermore, the K-DASH outcomes are not scored separately for each hand; thus, it is difficult to interpret the K-DASH outcome in conditions that often involve both hands, such as CTS. Compared with the K-DASH, the K-MHQ contains multiple domains, each of which can be scored individually. All domains (except for work and pain) assess the right and left hand separately, making it possible to assess both hands separately, and also allowing for scores of the affected hand to be compared with an unaffected control hand if only one hand is affected. In addition, the K-MHQ is more region-specific than the K-DASH in that it has questions relating to the hand only.

Our study has several limitations that require consideration. First, our study did not have a balanced sex ratio: the study had an overabundance of female patients (97.3%). This limits the generalizability of our results to the population, but it is not likely to affect the conclusions of our study because outcomes of CTS were not found to vary by gender.[13] Furthermore, similar demographics have been used in other prospective CTS studies.[18] Second, we lacked other general health measurement questionnaires that can be used for comparison; we also did not analyze any clinical factors such as physical findings that may influence the responsiveness of each score. Third, we did not compare the K-MHQ with the Boston carpal tunnel scores, which is a disease specific scale and is known to have a greater responsiveness than K-DASH in CTS.[11]

In conclusion, the K-MHQ was found to have a large degree of responsiveness after carpal tunnel release for Korean patients with CTS, which is comparable not only to the K-DASH, but also to the original version of the MHQ. The region-specific K-MHQ can be used for outcomes research related to carpal tunnel surgery, especially for research comparing CTS with various other hand and wrist conditions.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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Appendix 1. Korean version of the Michigan Hand Outcomes Questionnaire (K-MHQ)

이 설문지는 환자분의 손과 건강에 관한 것입니다. 여기서 얻어지는 정보는 의료진에게 환자분이 어떻게 느끼고, 일상생활을 얼마나 잘 할 수 있는가에 대한 정보를 제공 합니다. 해당 되는 모든 문항에 동그라미로 표시하시고, 만약 완전이 일치 하는 것이 없을 경우 가장 근접한 대답을 선택 하시면 됩니다.

I. 다음 질문은 지난 한 주 동안, 환자분의 손/손목의 기능에 관한 것 입니다. (각 질문의 해당 되는 곳에 동그라미로 표시 하십시오)

A. 다음 질문은 환자분의 우측 손/손목에 관한 것 입니다.

	매우 잘한다	잘한다	보통이다	나쁘다	아주 나쁘다
우측 손으로 얼마나 일을 잘 할 수 있습니까?	1	2	3	4	5
우측 손가락은 얼마나 잘 움직입니까?	1	2	3	4	5
우측 손목은 얼마나 잘 움직입니까?	1	2	3	4	5
우측 손의 근력은 어느 정도 입니까?	1	2	3	4	5
우측 손의 감각은 어느 정도 입니까?	1	2	3	4	5

B. 다음 질문은 환자분의 좌측 손/손목에 관한 것 입니다.

	매우 잘한다	잘한다	보통이다	나쁘다	아주 나쁘다
좌측 손으로 얼마나 일을 잘 할 수 있습니까?	1	2	3	4	5
좌측 손가락은 얼마나 잘 움직입니까?	1	2	3	4	5
좌측 손목은 얼마나 잘 움직입니까?	1	2	3	4	5
좌측 손의 근력은 어느 정도 입니까?	1	2	3	4	5
좌측 손의 감각은 어느 정도 입니까?	1	2	3	4	5

II. 다음 질문은 지난 한 주 동안, 환자분이 특정 일을 하는데 있어 손의 능력에 관한 것 입니다.
 (각 질문의 해당 되는 곳에 동그라미로 표시 하십시오)

A. 우측 손으로 다음과 같은 행동을 하는 것이 얼마나 어려웠습니까?

	전혀 어렵지 않다	약간 어렵다	중간정도 어렵다	상당히 어렵다	극히 어렵다
문 손잡이 돌리기	1	2	3	4	5
동전 줍기	1	2	3	4	5
물잔 들기	1	2	3	4	5
열쇠로 문 잠그기	1	2	3	4	5
프라이팬 잡기	1	2	3	4	5

B. 좌측 손으로 다음과 같은 행동을 하는 것이 얼마나 어려웠습니까?

	전혀 어렵지 않다	약간 어렵다	중간정도 어렵다	상당히 어렵다	극히 어렵다
문 손잡이 돌리기	1	2	3	4	5
동전 줍기	1	2	3	4	5
물잔 들기	1	2	3	4	5
열쇠로 문 잠그기	1	2	3	4	5
프라이팬 잡기	1	2	3	4	5

C. 양 손으로 다음과 같은 행동을 하는 것이 얼마나 어려웠습니까?

	전혀 어렵지 않다	약간 어렵다	중간정도 어렵다	상당히 어렵다	극히 어렵다
병 따기	1	2	3	4	5
셔츠/브라우스의 단추 잠그기	1	2	3	4	5
숫가락/젓가락으로 먹기	1	2	3	4	5
식료품 가방 들기	1	2	3	4	5
접시 씻기	1	2	3	4	5
머리 감기	1	2	3	4	5
구두 끈/리본 묶기	1	2	3	4	5

III. 다음 질문은 지난 4주 동안, 환자분이 일을 하는데 있어 어느 정도의 제약이 있었는가에 대한 것 입니다. −가사일, 학교 생활 포함−
　　(각 질문의 해당 되는 곳에 동그라미로 표시 하십시오)

	항상	자주	가끔	드물다	없다
손/손목의 문제로 얼마나 자주 일을 할 수 없었습니까?	1	2	3	4	5
손/손목의 문제로 얼마나 자주 일하다 조퇴를 하였습니까?	1	2	3	4	5
손/손목의 문제로 얼마나 자주 일을 하다 중간에 쉬어야 하였습니까?	1	2	3	4	5
손/손목의 문제로 얼마나 자주 일의 양을 줄여야 하였습니까?	1	2	3	4	5
손/손목의 문제로 얼마나 자주 업무 시간을 늘여야 하였습니까?	1	2	3	4	5

IV. 다음 질문은 지난 한 주 동안, 환자분이 손/손목에 느낀 통증에 관한 것 입니다. (각 질문의 해당 되는 곳에 동그라미로 표시 하십시오)

　　1. 얼마나 자주 손/손목에 통증을 느꼈습니까?
　　　1) 항상　　　2) 자주　　　3) 가끔　　　4) 드물다　　　5) 없다

만약 위의 대답이 "없다" 인 경우, 2번의 문항은 답하지 마시고, "V" 번 문항으로 바로 가십시오.

　　2. 손/손목의 통증 강도에 대해 답해 주십시오
　　　1) 아주 경미하다　　　2) 경미하다　　　3) 중간 정도이다　　　4) 심하다　　　5) 아주 심하다

	항상	자주	가끔	드물다	없다
3. 손/손의 통증으로 얼마나 자주 잠을 잘 자지 못했습니까?	1	2	3	4	5
4. 손/손의 통증으로 얼마나 자주 일상 생활에 지장이 있었습니까? (식사, 목욕)	1	2	3	4	5
5. 손/손의 통증으로 얼마나 자주 우울 하였습니까?	1	2	3	4	5

V. A. 다음 질문은 지난 한 주 동안 환자분의 우측 손의 모양에 관한 것 입니다. (각 질문의 해당 되는 곳에 동그라미로 표시 하십시오)

	완전일치	동의	그저 그렇다	불일치	완전 불일치
우측 손 모습에 만족 한다	1	2	3	4	5
우측 손 모습 때문에 종종 공공장소에서 불편하다	1	2	3	4	5
우측 손 모습 때문에 우울 하다	1	2	3	4	5
우측 손 모습 때문에 사회 생활에 제약이 있다	1	2	3	4	5

e3

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B. 다음 질문은 지난 한 주 동안 환자분의 좌측 손의 모양에 관한 것 입니다. (각 질문의 해당 되는 곳에 동그라미로 표시 하십시오)

	완전일치	동의	그저 그렇다	불일치	완전 불일치
좌측 손 모습에 만족 한다	1	2	3	4	5
좌측 손 모습 때문에 종종 공공장소에서 불편하다	1	2	3	4	5
좌측 손 모습 때문에 우울 하다	1	2	3	4	5
좌측 손 모습 때문에 사회 생활에 제약이 있다	1	2	3	4	5

VI. A. 다음 질문은 지난 한 주 동안 환자분의 우측 손/손목에 대한 만족 정도에 관한 것 입니다.
   (각 질문의 해당 되는 곳에 동그라미로 표시 하십시오)

	매우 만족한다	대체로 만족한다	그저 그렇다	다소 실망이다	매우 실망이다
우측 손의 전체적 기능	1	2	3	4	5
우측 손가락의 움직임	1	2	3	4	5
우측 손목의 움직임	1	2	3	4	5
우측 손의 근력	1	2	3	4	5
우측 손의 통증	1	2	3	4	5
우측 손의 감각	1	2	3	4	5

B. 다음 질문은 지난 한 주 동안 환자분의 좌측 손/손목에 대한 만족 정도에 관한 것 입니다.
   (각 질문의 해당 되는 곳에 동그라미로 표시 하십시오)

	매우 만족한다	대체로 만족한다	그저 그렇다	다소 실망이다	매우 실망이다
좌측 손의 전체적 기능	1	2	3	4	5
좌측 손가락의 움직임	1	2	3	4	5
좌측 손목의 움직임	1	2	3	4	5
좌측 손의 근력	1	2	3	4	5
좌측 손의 통증	1	2	3	4	5
좌측 손의 감각	1	2	3	4	5