

Original article

Comparison of responsiveness of the Japanese Society for Surgery of the Hand version of the carpal tunnel syndrome instrument to surgical treatment with DASH, SF-36, and physical findings

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Abstract

Background. The Japanese Society for Surgery of the Hand version of the Carpal Tunnel Syndrome Instrument (CTSI-JSSH), which consists of two parts — one for symptom severity (CTSI-SS) and the other for functional status (CTSI-FS) — is a self-administered questionnaire specifically designed for carpal tunnel syndrome. The responsiveness of the CTSI-JSSH was compared with that of the JSSH version of the Disability of Arm, Shoulder, and Hand questionnaire (DASH), the official Japanese version of the 36-Item Short Form Health Survey (SF-36, version 1.2), and physical examinations to elucidate the role of the CTSI-JSSH for evaluating patients with carpal tunnel syndrome.

Methods. Preoperatively, a series of 60 patients with carpal tunnel syndrome completed the CTSI-JSSH, DASH, and SF-36. Results of physical examinations, including grip strength, pulp pinch, and static two-point discrimination of the thumb, index, and long fingers, were recorded. Three months after carpal tunnel release surgery the patients were asked to fill out the same questionnaires, and the physical examinations were repeated. The responsiveness of all the instruments was examined by calculating the standardized response mean (SRM) and effect size (ES). Correlation coefficients were calculated between questionnaire change scores and patient satisfaction scores as well as between the CTSI change scores and those of the DASH and SF-36.

Results. The largest responsiveness was observed in the CTSI-SS (SRM/ES: -1.00/-1.08) followed by the CTSI-FS (-0.76/-0.63), and bodily pain subscale of SF-36 (SF-36-BP, 0.45/0.55), and the DASH (-0.46/-0.47). Only the change scores of the CTSI-SS had significant correlation with patient satisfaction

($r = 0.34$, $P < 0.01$). An absolute value of Spearman's correlation coefficient of >0.5 was observed between the change scores of the CTSI-SS and the DASH, the CTSI-SS and the SF-36-BP, the CTSI-FS and the DASH, and the DASH and the SF-36-BP.

Conclusion. The CTSI-JSSH was proven to be more sensitive to clinical changes after carpal tunnel release than the other outcome measures and should be used to evaluate patients with carpal tunnel syndrome who speak Japanese as their native language.

Introduction

Although carpal tunnel syndrome is the most common entrapment neuropathy in the human body, the operative indications are still not definitively determined. Thus, many procedures, such as traditional open carpal tunnel release, mini-open release, and endoscopic release, are performed based on the surgeon's preference, not on scientific data. It has been recognized that the development of disease-specific and patient-oriented outcome measures is necessary to compare various treatment modalities so the surgeons and patients can choose the best treatment procedure.

Levine et al. developed a self-administered questionnaire, or Carpal Tunnel Syndrome Instrument (CTSI), that is specific to carpal tunnel syndrome, and it has been used widely.¹ We developed a Japanese Society for Surgery of the Hand version of the CTSI (CTSI-JSSH) based on guidelines for cross-cultural adaptation processes recommended by Beaton et al.² The CTSI-JSSH is written in Japanese and consists of two sections: One

assesses pain and paresthesia, or symptom severity (CTSI-SS); and the other assesses functional status (CTSI-FS). It is now available in *Charts for Functional Evaluation of the Hand* (4th edition).³ Validity, reliability, and responsiveness of the Japanese versions of both the CTSI-SS and CTSI-FS were found to be good.⁴

In this study, the responsiveness of the CTSI-JSSH was compared with that of the Japanese Society for Surgery of the Hand version of the Disability of Arm, Shoulder, and Hand questionnaire (DASH-JSSH),^{5,6} the official Japanese version of the 36-Item Short Form Health Survey (SF-36; version 1.2),^{7,8} and physical examinations to elucidate the role of the CTSI-JSSH for evaluating patients with carpal tunnel syndrome.

Materials and methods

We prospectively recruited 65 patients who had been diagnosed with carpal tunnel syndrome and who gave written informed consent. This was a multicenter study, and the ethics committee of each institution approved the study protocol. One female patient who was unable to fill out the forms by herself because of poor eyesight was not recruited. The diagnosis of carpal tunnel syndrome was based on the clinical history and physical examinations, such as Phalen's test, Tinel's sign at the carpal tunnel, sensory disturbance over the median nerve distribution area, and nerve conduction velocities measured across the wrist. Based on nerve conduction studies, the severity of preoperative carpal tunnel syndrome was determined as mild, moderate, severe, or extremely severe.⁹

Preoperatively, the patients were asked to fill out the CTSI-JSSH, DASH, and SF-36. Pain severity was assessed using the Visual Analog Scale (VAS). Results of physical examinations, including grip strength, pulp pinch, and static two-point discrimination (s-2PD) of the thumb, index, and long fingers, were recorded. A total of 43 patients underwent endoscopic carpal tunnel release surgery, and 22 underwent open carpal tunnel release. Six patients had bilateral surgeries on the same day. One patient had diabetes, two were undergoing hemodialysis, two had had distal radial fractures, and one had a ganglion in the carpal tunnel. Six patients had release of the A1 pulley or synovectomy for trigger digit, and two patients had tendon transfer to restore thumb opposition followed by 3 weeks of immobilization of the wrist and thumb. Because the prime purpose of this study was to assess the responsiveness of the CTSI-JSSH and not to report the results of carpal tunnel release surgery, the two patients who had undergone tendon transfer were included.

Three months after surgery, the patients were asked to fill out the same questionnaires, and the physical

examinations were repeated. This time each patient rated his or her satisfaction with the surgery into four categories: very satisfied, satisfied, neither satisfied nor unsatisfied, unsatisfied.

Grip strength was measured using a Jamar dynamometer (Sammons Preston Rolyan, IL, USA) or a Smedley's hand dynamometer (Igarashi Ikakougyou, Tokyo, Japan), and pinch strength was measured using a Jamar pinch meter (Sammons Preston Rolyan) or a Pinch gauge (Fuji Seiko, Nagoya, Japan). They were measured three times each, and the average was used for analysis. The values of s-2PD of the thumb, index, and long fingers were summed, and the average was used for analysis. The patients rated their degree of pain using a VAS range from 0 to 10 (0, no pain → 10, the most severe pain ever experienced).

The responsiveness of all the instruments was examined by calculating the standardized response mean (SRM; mean change/SD) and effect size (ES; mean change/SD of the baseline value). SRM > 0.8 indicated large change, 0.5 indicated moderate change, and <0.2 indicated small change. Correlation coefficients were calculated between questionnaire change scores and patients' satisfaction scores, and between the CTSI change scores and those of the DASH and SF-36.

All statistical analyses were conducted using Statistical Package for Social Science (SPSS) version 14.0J software. As some of the instrument values were not normally distributed, correlations between the instruments and patient satisfaction were assessed using a nonparametric test (Spearman's correlation). Statistical significance was set at $P < 0.05$.

Results

Five patients were excluded from the study because their second data acquisition was done more than 15 weeks after surgery, leaving 60 patients eligible for analysis. There were 11 men and 49 women whose ages ranged from 21 to 86 years (average 60 years). The duration of the symptoms before their first visit to the hospital ranged from 2 to 360 months (average 60 months). Preoperative severity of the disease determined by nerve conduction studies was as follows: normal 1 patient, mild 0, moderate 9, severe 40, extremely severe 9, not available 1. All the surgeries were correctly performed because complete release of the transverse carpal ligament was confirmed intraoperatively, and no postoperative complications such as infection, nerve/tendon injuries, or aggravation of numbness were noted. Nine patients developed a trigger digit within 3 months after surgery.

The average pre- and postoperative values of each instrument and the SRM and ES are summarized in

Table 1. Responsiveness of each instrument

Instrument	Preoperative		Postoperative		Postoperative – preoperative			Responsiveness	
	Mean	SD	Mean	SD	Mean	Median	SD	SRM	ES
CTSI-SS (60)***	2.59	0.72	1.81	0.67	-0.77	-0.80	0.78	-1.00	-1.08
CTSI-FS (59)**	2.28	0.87	1.71	0.64	-0.55	-0.50	0.72	-0.76	-0.63
DASH-DS (55)***	33.3	19.6	23.8	18.5	-9.14	-9.17	19.7	-0.46	-0.47
SF-36-PF (60)	72.2	24.1	71.8	26.6	-0.43	0	22.8	-0.02	-0.02
SF-36-RP (58)	54.0	41.0	56.8	42.3	2.44	0	41.9	0.06	0.06
SF-36-BP (60)***	46.3	22.2	58.4	24.1	12.1	11.5	27.2	0.45	0.55
SF-36-GH (59)	57.5	18.3	59.1	16.3	1.57	0	15.0	0.10	0.09
SF-36-VT (59)	56.3	21.3	60.2	22.6	4.07	5	21.7	0.19	0.19
SF-36-SF (60)	77.9	24.4	82.9	21.5	5.00	0	21.1	0.24	0.20
SF-36-RE (56)	66.1	42.9	63.2	42.2	-2.98	0	46.4	-0.06	-0.07
SF-36-MH (58)	67.4	18.8	70.1	19.8	2.98	4	19.7	0.15	0.16
VAS (57)*	3.3	3.1	2.3	2.4	-1.0	-0.5	3.6	-0.29	-0.34

Numbers in parentheses indicate the number of tests performed

SRM, standardized response mean; ES, effect size; CTSI-JSSH-SS, Symptom Severity scale of the Japanese Society for Surgery of the Hand Version of Carpal Tunnel Syndrome Instrument (CTSI-JSSH); CTSI-JSSH-FS, Functional Status scale of CTSI-JSSH; DASH-JSSH, Disability/Symptom scale of the Japanese version of DASH; SF-36-PF, physical functioning subscale of the 36-Item Short-Form Health Survey (SF-36); SF-36-RP, role-physical subscale of SF-36; SF-36-BP, bodily pain subscale of SF-36; SF-36-GH, general health subscale of SF-36; SF-36-VT, vitality subscale of SF-36; SF-36-SF, social functioning subscale of SF-36; SF-36-RE, role-emotional subscale of SF-36-MH, mental health subscale of SF-36; VAS [0–10], Visual Analog Scale for pain [0–10 scale]

* Significant difference between preoperative and postoperative median value ($P < 0.05$)

** Significant difference between preoperative and postoperative median value ($P < 0.01$)

*** Significant difference between preoperative and postoperative median value ($P < 0.001$)

Table 2. Responsiveness of grip strength, pinch strength, and s-2PD

Instrument	Preoperative		Postoperative		Postoperative – preoperative			Responsiveness	
	Mean	SD	Mean	SD	Mean	Median	SD	SRM	ES
Grip strength (66)*	16.38	9.37	14.81	7.29	-1.57	-1.17	6.04	-0.26	-0.17
Pinch (66)	5.52	2.55	5.65	2.72	0.13	-0.13	1.42	0.09	0.05
s-2PD (59)**	8.45	4.18	7.09	3.31	-1.40	-0.67	3.25	-0.43	-0.33

Numbers in parentheses indicate the number of tests performed

s-2PD, static two-point discrimination

* Significant difference between the preoperative and postoperative median values ($P < 0.05$)

** Significant difference between the preoperative and postoperative median values ($P < 0.01$)

Tables 1 and 2. Significant improvement was observed in the CTSI-SS, CTSI-FS, DASH, bodily pain subscale of SF-36 (SF-36-BP), VAS, and s-2PD ($P < 0.01$). Grip strength decreased significantly after 3 months postoperatively ($P < 0.05$). The largest responsiveness was observed in the CTSI-SS (SRM/ES: -1.00/-1.08), followed by the CTSI-FS (-0.76/-0.63), SF-36-BP (0.45/0.55), and DASH (-0.46/-0.47). Only the change scores of the CTSI-SS had a significant correlation with patient satisfaction ($r = 0.34$, $P < 0.01$) (Table 3).

An absolute value of Spearman's correlation coefficient of >0.5 was observed between the change scores of the CTSI-SS and the DASH, the CTSI-SS and the SF-36-BP, the CTSI-FS and the DASH, and the DASH and the SF-36-BP (Table 3).

Sixteen patients had worse scores in the DASH or CTSI-SS 3 months after surgery. Eight patients had

worse scores in the DASH, whereas the CTSI-SS was improved. Six patients had worsening of both the DASH and the CTSI-SS, and two patients had worsening of only the CTSI-SS. Although statistical analysis was not performed owing to the small sample size, the patients with worsening of the DASH score tended to have a long duration of symptoms, severe stage of the disease, and development of trigger digit, as well as pain over and around the wound.

Discussion

The responsiveness of the CTSI-SS and the CTSI-FS was found to be greater than that of the DASH, the subscales of SF-36, VAS, and the physical findings 3 months after surgery. This was consistent with previous

Table 3. Correlation of change scores of each instrument

Instrument scale	Correlation with			
	CTSI-SS	CTSI-FS	DASH	Satisfaction ($n = 58$)
CTSI-SS (60)	—	—	—	0.337**
CTSI-FS (59)	0.467**	—	—	0.175
DASH (55)	0.665**	0.641**	—	0.196
SF-36-PF (60)	-0.318*	-0.371**	-0.485**	-0.236
SF-36-RP (58)	-0.358**	-0.291*	-0.410**	0.051
SF-36-BP (60)	-0.580**	-0.397**	-0.621**	-0.254
SF-36-GH (59)	0.318*	-0.145	-0.292*	-0.252
SF-36-VT (59)	-0.412**	-0.421**	-0.392**	-0.188
SF-36-SF (60)	-0.186	-0.350**	-0.324**	-0.028
SF-36-RE (56)	-0.437**	-0.264	-0.420**	-0.06
SF-36-MH (58)	-0.267*	-0.474**	-0.449**	-0.102
VAH (57)	0.355**	-0.186	-0.393**	-0.108
Grip strength (66)	-0.181	0.064	-0.142	0.002
Pinch (66)	-0.183	-0.147	-0.056	-0.174
s-2PD (60)	0.003	0.013	0.026	-0.03

* $P < 0.05$, ** $P < 0.01$; Spearman's correlations (r_s)

Boldface results indicate a significant correlation, when $P < 0.05$ and $|r_s| > 0.5$

Table 4. Correlation of instrument scale with grip strength and pinch

Instrument scale	Correlation with grip strength	Correlation with pinch
Grip strength (66)	—	—
Pinch (66)	0.345**	—
s-2PD (60)	0.001	-0.204

** $P < 0.01$, Spearman's correlation (r_s)

reports.¹⁰⁻¹² Gay et al. found the CTSI was most sensitive to clinical changes after carpal tunnel release (ES/SRM: 1.77/1.66), followed by the DASH (1.01/1.13), the SF-36-BP (0.57/0.52), and the role-physical subscale of SF-36 (0.39/0.39).¹¹ Greenslade et al. reported that SRMs of the CTSI-SS, CTSI-FS, and DASH were 1.07, 0.62, and 0.66, respectively 3 months after open carpal tunnel release.¹² Atroshi et al. reported a good response of the CTSI-SS (1.4–1.9), CTS-FS (0.8–1.1), and SF-36 (1.0) 3 months after endoscopic carpal tunnel release.

Although the CTSI is sensitive to clinical changes after carpal tunnel release, more generic instruments such as the DASH or the SF-36 may be useful if the relative impact of carpal tunnel syndrome on the entire upper extremities or the body is evaluated. Patients with carpal tunnel syndrome scored low on the SF-36, but 3 months after surgery only bodily pain was alleviated significantly. It is unclear whether carpal tunnel release affected the patients' general health status within the 3-month follow-up.

Carpal tunnel release surgery does not always relieve the symptoms completely or immediately. After sur-

gery, patients experience pain over the wound or the stumps of the transverse carpal ligament that could last several months.¹³ During the 3 months after surgery, numbness in the contralateral side of the hand is some times aggravated, and trigger digit can also develop. Furthermore, patients with an extremely severe stage of the disease, especially those with diabetes, might not feel significant alleviation of numbness with in a short follow-up period. These factors may explain the fact that grip strength decreased and pinch strength did not improve after surgery and that the DASH and the CTSI-FS were not as sensitive as the CTSI-SS even though surgery was done correctly. The DASH and CTSI-SS are affected more by functional changes, whereas the CTSI-SS is affected by paresthesia or pain (or both), which can improve soon after surgery.

Although statistically not compared, SRM or ES of the CTSI in our patients was less than that found by previous investigators.^{6,10-13} Only Greenslade et al. reported data almost comparable to ours.¹¹ There are a few factors that should be considered before making direct comparisons.

Some reports did not provide any information regarding the duration of the symptoms, the severity of the disease, or the presence of coexisting disease; furthermore, our study population had more severe stages of the disease (as determined by nerve conduction studies), longer duration of the symptoms, or older age than was reported in the other studies.^{10,11,14,15} Simply comparing the SRM or ES among the studies should be done with caution, with other outcome measures being included to ensure adequate comparison of the procedures.¹³

Conclusions

The CTSI-JSSH version was proven to be more sensitive to clinical changes after carpal tunnel release than the other outcome measures. Thus, it should be used to evaluate patients with carpal tunnel syndrome who speak Japanese as their native language.

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