

Adaptation of Turkish version of the questionnaire Quick Disability of the Arm, Shoulder, and Hand (Quick DASH) in patients with carpal tunnel syndrome

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Abstract The aim of this study was to assess the reliability and validity of the Turkish version of the Quick Disability of the Arm, Shoulder, and Hand (Quick DASH) scale in patients with carpal tunnel syndrome (CTS). Sixty nine patients with idiopathic CTS were included. The Quick DASH questionnaire consists of three subscales including disability/symptom, and work and sports/performing arts. Quick DASH was administered after translation process to subjects twice a week for testing reliability. The validity was based on correlating Quick DASH with the Boston Questionnaire, visual analogue scale—pain (VAS-pain), and pinch and grip strength tests. Reliability of the Turkish version of the Quick DASH scale was very good with high internal consistency (Cronbach's alpha 0.84 for disability/symptom subscale, 0.937 for work subscale, and 0.926 for sports/performing arts subscale) and test–retest reliability (intraclass correlation coefficient 0.931 for disability/symptom subscale, 0.925 for work subscale, and 0.779 for sports/performing arts subscale). The disability/symptom subscale had moderate correlations with the VAS-pain and grip strength test and good correlation with the pinch strength test. The work subscales had moderate correlations with VAS-pain, and pinch and pinch grip strength tests. A high correlation was found between the disability/symptom and work subscales with Boston symptom severity and Boston functional status subscores. The Turkish version of Quick DASH was reliable and valid for evaluating symptoms and functional disability in patients with CTS. Our results suggest that Quick DASH could be preferred as it is a simple and easy scale to use.

Keywords Carpal tunnel syndrome · Quick DASH · Reliability · Validity

Introduction

Carpal tunnel syndrome (CTS) is one of the most common entrapment neuropathies characterized by pain, numbness, and tingling in the hands resulting in disability of the upper extremity. The prevalence of this condition is 3–5.8% among women and 0.6–2.1% among men in the general population [1–4].

Several tools have been developed for the assessment of upper extremity functions. These questionnaires are joint specific, disease specific, or region specific [5–8]. In clinical practice, the patients' assessment of their symptoms, quality of life, and functional capacity became more important in clinical practice [9, 10]. Thereby, patient-oriented outcome measures are recommended rather than physician-based measurements in clinical research [10, 11].

There was no standardized measurement to assess the severity, functional capacity, and treatment outcomes of CTS until Levine et al. developed a self-assessment disease-specific questionnaire [2, 5]. Also, the scale of Disability of the Arm, Shoulder, and Hand (DASH) is a self-administered, region-specific tool which was developed for evaluating the health status of the patients with upper extremity disorders and has been validated in several languages [6, 8, 12–21]. The DASH was found to be a reliable outcome instrument in CTS [22]. Shorter questionnaires are well accepted as they are easy to understand and can be quickly completed by the patients and with less burden for the physicians scoring the items. With this respect, the DASH was shortened to develop the 11-item Quick Disability of the Arm, Shoulder, and Hand question-

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naire (Quick DASH). It has been developed to measure physical function and symptoms in patients with upper extremity disorders [23]. Recently, the validity and reliability of Japanese and French versions of Quick DASH were reported [6, 24].

The aim of this study was to assess the reliability and validity of the Turkish version of Quick DASH scale in patients with CTS.

Materials and methods

The Quick Disability of the Arm, Shoulder, and Hand questionnaire

The DASH questionnaire is a region-specific, self-report scale to evaluate health status of upper extremity disabilities. It has been shown to be reliable and valid in different languages [6, 8, 12–21]. The questionnaire includes a 30-item disability/symptom scale: function (21 items), symptom severity (six items), and psychological factors (three items); and two optional scales: work (four items) and sports/performing arts (four items) [8, 22].

The Quick DASH is a shortened version of DASH to measure physical function and symptoms in patients with musculoskeletal disorders of the upper limb. The questionnaire consists of a disability/symptom scale (11 items) and two optional scales: work (four items) and sports/performing arts (four items). In disability/symptom scale, each item asks about the severity of pain, activity-related pain, tingling, weakness and stiffness, difficulty in performing physical activities because of upper extremity problem, effect of upper extremity problem on social activities, work, and sleep. Two optional modules measure the ability to work and the ability to perform sports and/or play musical instruments. The answers are given based on a one-to-five scale, and each question is scored between 1 and 5. The scores of three subscales of Quick DASH, disability/symptom scale, work scale, and sports/performing arts scale, all ranged between 0 (no disability) and 100 (most severe disability) [6, 23]. The validity and reliability of Japanese and French versions of Quick DASH were reported [6, 24].

The adaptation process

The Quick DASH was adapted to the Turkish population using recommended guidelines for cross-cultural adaptation [25]. Three authors (one medical doctor, Nihal C; one engineer, Ozgur D; and one English teacher, Bilge O), whose native languages are Turkish, translated the index into Turkish language. The translations were reviewed and a synthesis of it was performed. Then it was translated back

to English by one bilingual author (Sukran A) whose native language was English. A committee (medical doctor, translator, and English teacher) controlled the grammar of the index and compared it with the original questionnaire. The prefinal version was administered to 40 patients with CTS attending to the outpatient clinic of physical medicine and rehabilitation. The patients were interviewed to make a decision if all items were easily understood. Then the final version was produced and aimed to evaluate the validity and reliability in patients with CTS.

Patients and assessments

The Turkish version of Quick DASH was administered to 69 patients (62 female and seven male) with CTS. The diagnosis of CTS was based on the physical examination and electrophysiological studies. Patients with diabetes mellitus, thyroid disease, rheumatoid arthritis, radiculopathy of cervical spine, pregnancy, cognitive impairment, hand surgery within previous 3 months, and illiterate patients were excluded. The sociodemographic characteristics of the patients (age, sex, education, and occupation) were recorded.

The Quick DASH was applied to subjects twice a week for testing reliability. The validity was based on performing additional tests including pain severity and functional capacity. Pain severity in the last week was assessed by using the visual analogue scale (VAS). Functional capacity was evaluated with pinch and grip strengths by using a Jamar hydraulic hand dynamometer (200 lb, Sammons Preston, Inc.) and a pinch meter (23 kg/50 lb, Sammons Preston, Inc.). To perform construct validity, patients were also assessed by the Boston questionnaire. It is a self-administered, disease-specific scale that assesses the severity of symptoms and functional status in patients with CTS [5]. Also, the Turkish version of the Boston questionnaire was found to be valid and reliable in CTS patients [11].

Signed written informed consent was obtained from all patients. The human research ethics committee of the School of Medicine of Ufuk University approved the study.

Statistical analysis

All statistical analyses were performed using SPSS version 16 for Windows computer software package. All data were tested for normality using the Kolmogorov–Smirnov statistic test.

Reliability

Reliability is defined as obtaining the same results on successive administrations without a change in physical

conditions. It is composed of reproducibility (test–retest reliability) and internal consistency [9].

Test–retest reliability

Correlations of two successive administrations within a week (2 or 3 days after the first administration) were evaluated with the intraclass correlation coefficient (ICC) with 95% confidence interval. It ranges between 0 and 1, and the results over 0.70 were accepted as adequate for reliability [26]. Test–retest reliability is assessed by comparing instrument scores at two time points, given that there has been no change in condition between administrations [27].

Internal consistency

Internal consistency determines the homogeneity of the subscale, and it can also be described as intercorrelation of the items in an instrument [9]. It was assessed by Cronbach's alpha and item total correlation. Cronbach's alpha coefficient ranges from 0 to 1. The closer values to 1 show a higher internal consistency of the instrument [28].

Construct validity

Construct validity is the level of availability to measure the aim of the assessment. It was evaluated with Spearman correlation coefficient. A value between 0 and 0.25 was accepted as 'no or poor', 0.26–0.50 as 'moderate', 0.51–0.75 as 'good', and 0.76–1.00 as 'very good' correlations [11, 25].

Construct validity was evaluated with correlation between the Boston questionnaire, pain severity with VAS, and functional status including grip and pinch grip strength tests. We chose more than one method to evaluate both pain severity and functional capacity of the patients with CTS to increase the methodologic value of the study. We preferred the Boston questionnaire because this questionnaire consists of two subscales (symptom severity and functional status subscales). Both the severity of symptoms and functional status of the patients can be evaluated with this scale. Also, the Turkish version of this scale is found to be reliable and valid in patients with CTS [11].

Results

In adaptation process, the prefinal version was filled out by 40 patients, and they concluded that all items were easily understandable. No difficulty in understanding and completing the questionnaire by patients was detected. Then we

administered the questionnaire to the patients without any change.

Sixty nine patients (62 female and seven male) with a mean age of 52.4 ± 11.6 years with idiopathic CTS were included in this study. The sociodemographic characteristics and diagnoses of the patients are given in Table 1. All patients easily completed the disability/symptom subscale. The work subscale was filled out by 26 patients and sports/performing arts subscale was filled out by five patients with CTS.

Test–retest reliability

There was a very good reliability for disability/symptom subscale, work subscale, and sport/performing arts subscale of Quick DASH with a high ICC between the two time points. The ICCs ranged from 0.77 to 0.93. The ICCs are presented in Table 2.

Internal consistency

The Cronbach's alpha values for Quick DASH disability/symptom, Quick DASH work, and Quick DASH sport/performing arts subscores were 0.84, 0.93, and 0.92, respectively (Table 2).

Construct validity

The disability/symptom subscale had moderate correlations with VAS-pain and grip strength ($r=0.44$, $p=0.000$; $r=-0.35$, $p=0.002$) and good correlation with pinch strength ($r=-0.54$, $p=0.000$). The work subscales had moderate correlations with VAS-pain, and grip and pinch

Table 1 Sociodemographic characteristics of the patients with CTS

Variables	Mean \pm SD; N (%)
Age (year)	52.43 \pm 11.63
Gender	
Female	62 (88.9%)
Male	7 (10.1%)
Occupation	
Housewife	46 (66.7%)
Officer	6 (8.7%)
Retired	10 (14.5%)
Employer	1 (1.4%)
Localization	
Right hand	12 (17.4%)
Left hand	15 (21.7%)
Bilateral	42 (60.9%)
Disease duration (months)	49.78 \pm 57.44

SD standard deviation

Table 2 Test–retest reliability scores and intraclass correlation coefficients

Quick DASH subscales	Test (mean ± SD)	Retest (mean ± SD)	ICC (95% CI)
Quick DASH disability/symptom	50.13±19.10	49.83±20.47	0.93 (0.89–0.95)
Quick DASH work	50.18±22.09	49.54±21.5	0.92 (0.88–0.95)
Quick DASH sport/performing arts	22.50±20.53	28.75±21.46	0.77 (–0.89–0.97)

DASH Disability of the Arm, Shoulder, and Hand; *SD* standard deviation; *ICC* intraclass correlation coefficient; *CI* confidence interval

strength ($r=0.34$, $p=0.004$; $r=-0.36$, $p=0.002$; and $r=-0.41$, $p=0.000$). A high correlation was found between the disability/symptom and work subscales with Boston symptom severity subscores ($r=0.68$, $p=0.000$; $r=0.63$, $p=0.000$) and Boston functional status subscores ($r=0.77$, $p=0.000$; $r=0.725$, $p=0.000$).

No correlations were detected between Quick DASH sport/performing arts subscores and pain severity, functional status, and Boston questionnaire. Correlation coefficients are presented in Table 3.

Discussion

There are many tools to assess CTS such as provocative tests, hand grip–pinch grip strength tests, and nerve conduction studies. But none of these methods exactly measure the symptoms and related handicap and disabilities in daily living activities. Also, the patients' and physicians' assessment of disease and functional capacity are mostly different from each other. Therefore, patients' perceptions of his or her impairment are increasingly being considered important, and self-administered questionnaires are recommended for the measurement [2, 10, 11, 29].

The Quick DASH is a self-assessment instrument that can be administered in a short time without any burden on patients and physicians [23, 30]. The reliability of Quick DASH and DASH was found to be similar [31]. The original Quick DASH has been shown to be reliable and valid in patients with upper extremity disorders including CTS [23].

One of the limitations of this study is the use of the shorter version Quick DASH rather than the original DASH, as there is no Turkish version of DASH. Another limitation is the small sample size. Moreover, the optional modules of the scale were filled out by a few patients. Only five patients have completed the sports/performing arts subscale. This shows us that the patients were not clear about what “optional” subscale means. Twenty six patients (six officers, one employer, and 19 housewives) have completed the work subscale. In the instructions of the Quick DASH, it was stated that the questions of work module is about the ability to work including homemaking. So, most of the housewives also completed the work subscale of Quick DASH. Other housewives who did not complete the subscale might have not understood it. The reason of low numbers of patients who completed the work subscales was also due to the low numbers of active working patients (the total number of active working

Table 3 The correlation coefficients between the Quick DASH subscores, pain severity, functional capacity, and the Boston questionnaire

	Quick DASH disability/symptom	Quick DASH work	Quick DASH sport/performing arts
VAS	0.449*	0.341*	–0.462
	0.000	0.004	0.434
Hand grip strength	–0.359*	–0.362*	0.154
	0.002	0.002	0.805
Pinch grip strength	–0.544*	–0.412*	–0.359
	0.000	0.000	0.553
Boston symptom severity subscale	0.684*	0.635*	0.289
	0.000	0.000	0.637
Boston functional status subscale	0.772*	0.725*	0.359
	0.000	0.000	0.553

* $p<0.01$

VAS visual analogue scale; *DASH* Disability of the Arm, Shoulder, and Hand

patients were six officers and one employer). Also, another limitation of this study is not to measure the completion time of the Quick DASH.

The quality of a measurement is based on reliability, validity, and ease of use [32]. The Quick DASH was adapted to the Turkish population using recommended guidelines [25]. Patients had no difficulty in completing the questionnaire. We found good test–retest reliability with high ICC for all three subscores (0.93, 0.92, and 0.77) of two non-consecutive administrations. This was similar to that found with the original DASH (ICC=0.96), the German version (ICC=0.90), and the Swedish version (ICC=0.92) of DASH [13, 15, 23]. Our results were consistent with that of the original Quick DASH (ICC=0.94) which was reported by Beaton et al. [23]. In the French version of Quick DASH, a similar ICC of 0.94 in patients with shoulder disorders was reported [24]. Our findings support the results of Greenslade et al. in their study who found high reliability in DASH with a coefficient of 0.90 in patients with CTS [22]. Furthermore, our ICC was higher than the Japanese version of Quick DASH in upper extremity disorders including CTS [6].

This difference may be due to the administration of the Turkish version within 2–3 days compared to the administration of Japanese version in 6–17 days. These results are given in Table 4.

None of these studies evaluated the optional modules of Quick DASH. Only Matheson et al. assessed the visual analogue version of Quick DASH with the work component and reported high test–retest reliability with 0.90 (with work component) and 0.94 (without work component) ICC scores, which were consistent with our data [33] (Table 4).

A higher internal consistency with Cronbach's alphas 0.97 and 0.94 was found in the original DASH and the original Quick DASH [23]. Similarly, high internal consistency with Cronbach's alpha coefficients 0.88 and 0.89 of Quick DASH disability/symptom subscale in Japanese and French versions was reported [6, 24]. Consistent with these findings, in our study, the Cronbach's alphas for disability/symptom, work, and sports/performing arts subscales were 0.84, 0.93, and 0.92, respectively. This indicates that the Turkish version of the Quick DASH has high internal consistency reliability for all items of the questionnaire. These results are shown in Table 4.

Table 4 Comparison of the reliability and validity of Quick DASH in different languages

	ICC (95% CI)	Cronbach's alpha	Construct validity
Turkish version of Quick DASH disability/symptom	0.93 (0.89–0.95)	0.84	0.449, with pain severity –0.359, with hand grip strength –0.544, with pinch grip strength 0.684, with Boston symptom severity subscale 0.772, with Boston functional status subscale
Turkish version of Quick DASH work	0.92 (0.88–0.95)	0.93	0.341, with pain severity –0.362, with hand grip strength –0.412, with pinch grip strength 0.635, with Boston symptom severity subscale 0.725, with Boston functional status subscale
Turkish version of Quick DASH sport/performing arts	0.77 (–0.89–0.97)	0.92	–0.462, with pain severity 0.154, with hand grip strength –0.359, with pinch grip strength 0.289, with Boston symptom severity subscale 0.359, with Boston functional status subscale
Original Quick DASH disability/symptom Beaton et al. [23]	≥0.94	≥0.92	≥0.64, with pain severity
French version of Quick DASH disability/symptom Fayad et al. [24]	0.94	0.89	≥0.57, with pain severity
Japanese version of Quick DASH disability/symptom Imaeda et al. [6]	0.82 (0.69–0.90)	0.88	0.52, with pain severity –0.29 to –0.73, with SF-36
Visual analogue version of Quick DASH disability/symptom without work component	0.90 (0.81–0.95)		
Visual analogue version of Quick DASH disability/symptom with work component Matheson et al. [34]	0.94 (0.89–0.97)		

DASH Disability of the Arm, Shoulder, and Hand; ICC intraclass correlation coefficient; CI confidence interval

A correlation between original Quick DASH and DASH was reported by Beaton et al. [23]. In the Japanese version of Quick DASH, a moderate correlation was found between Quick DASH disability/symptom score and VAS-pain [6]. In the French version, Fayad et al. reported good correlation between Quick DASH disability/symptom score and pain severity at rest and during activities in patients with shoulder disorders [24]. In this study, validity was based on correlations between the three scores of Quick DASH and VAS-pain, grip strength, and pinch strength tests. We observed moderate correlations between disability/symptom subscale with VAS-pain and grip strength test and good correlation with pinch strength test. The work subscales had moderate correlations with VAS-pain, and grip and pinch strength tests. Our findings were consistent with the Japanese and French versions of Quick DASH [6, 24]. These findings are given in Table 4. In the original version of the Boston questionnaire, moderate and good correlations were reported with pinch and grip strength tests [5]. Sezgin et al. also determined similar correlations between both scales of the Turkish version of the Boston questionnaire with VAS-pain and grip strength and pinch strength [11].

Fan et al. evaluated the correlation between Quick DASH and Short Form-12 (SF-12) and reported moderate correlation among workers with neck or upper extremity musculoskeletal disorders [34]. In the Japanese version of Quick DASH, a strong correlation was shown between Quick DASH disability/symptom score and Short Form-36 (SF-36) subscales (role of physical health, physical functioning, and bodily pain) in patients with upper extremity disorders [6] (Table 4). In the present study, patients were also assessed by the Boston questionnaire. The Boston questionnaire is a disease-specific, self-administered measurement which was developed for the assessment of symptom severity and functional status for CTS by Levine et al. [5]. This questionnaire has been translated into Turkish and was found to be reliable and valid [11]. A high correlation was found between the disability/symptom and work subscales with the Boston symptom severity subscores and Boston functional status subscores. These findings indicate that either Quick DASH or Boston questionnaire can be used in patients with CTS.

No correlations were detected between Quick DASH sport/performing arts subscores and pain severity, functional status, and Boston questionnaire, but these results did not reach a level of significance. These findings can be explained by that only a few patients filled out the Quick DASH sport/performing arts subscale.

As a conclusion, the Turkish version of Quick DASH is found to be reliable and valid in patients with CTS. The strong correlations suggest that Quick DASH may be preferred because it is easier to use.

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References

1. Uchiyama S, Imaeda T, Toh S, Kusunose K, Sawaizumi T, Wada T, Okinaga S, Nishida J, Omokawa S (2007) 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. *J Orthop Sci* 12:249–253
2. Fok MWM, Leung HB, Lee WM (2007) Evaluation of a Hong Kong Chinese version of a self administered questionnaire for assessing symptom severity and functional status of carpal tunnel syndrome: cross-cultural adaptation and reliability. *Hong Kong Med J* 13:342–347
3. Atroshi I, Gummesson C, Johnsson R, Ornstein R, Ranstam J, Rosen I (1999) Prevalence of carpal tunnel syndrome in a general population. *JAMA* 282(2):153–158
4. Thomsen JF, Gerr F, Atroshi I (2008) Carpal tunnel syndrome and the use of computer mouse and keyboard: a systematic review. *BMC Musculoskelet Disord* 9:134, Review
5. Levine DW, Simmons BP, Koris MJ, Daltroy LH, Hohl GG, Fossel AH, Katz JN (1993) A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. *J Bone Jt Surg* 75(11):1585–1592
6. Imaeda T, Toh S, Wada T, Uchiyama S, Okinaga S, Kusunose K, Sawaizumi T (2006) Validation of the Japanese Society for Surgery of the Hand version of the Quick Disability of the Arm, Shoulder, and Hand (QuickDASH-JSSH) questionnaire. *J Orthop Sci* 11:248–253
7. Richards RR, An KN, Bigliani LU, Friedman RJ, Gartsman GM, Gristina AG, Research Committee, American Shoulder and Elbow Surgeons et al (1994) A standardized method for the assessment of shoulder function. *J Shoulder Elbow Surg* 3:347–352
8. Hudak PL, Amadio PC, Bombardier C, The Upper Extremity Collaborative Group (UECG) (1996) Development of an upper extremity outcome measure: the DASH (Disabilities of the Arm, Shoulder, and Hand). *Am J Ind Med* 29:602–608
9. Echaute C, Vaes P, Aerschot LV, Asman S, Duquet W (2007) The clinimetric qualities of patient-assessed instruments for measuring chronic ankle instability: a systematic review. *BMC Musculoskelet Disord* 8:6
10. Guillemin F (2000) Functional disability and quality-of-life assessment in clinical practice. *Rheumatology* 39(suppl):17–23
11. Sezgin M, Arinci Incel N, Sevim S, Camdeviren H, As I, Erdogan C (2006) Assessment of symptom severity and functional status in patients with carpal tunnel syndrome: reliability and validity of the Turkish version of the Boston Questionnaire. *Disability and Rehabilitation* 1–6
12. Fayad F, Lefevre-Colau MM, Mace Y, Gautheron V, Fermanian J, Roren A, Roby-Brami A, Revel M, Poiradeau S (2008) Responsiveness of the French version of the Disability of the Arm, Shoulder, and Hand questionnaire (F-DASH) in patients with orthopaedic and medical shoulder disorders. *Joint Bone Spine* 75:579–584
13. Atroshi I, Gummesson C, Andersson B, Dahlgren E, Johansson A (2000) The disabilities of the arm, shoulder and hand (DASH) outcome questionnaire: reliability and validity of the Swedish version evaluated in 176 patients. *Acta Orthop Scand* 71(6):613–618

14. Rosales RS, Delgado EB, Diez de la Lastra-Bosch I (2002) Evaluation of the Spanish version of the DASH and carpal tunnel syndrome health-related quality-of-life instruments: cross-cultural adaptation process and reliability. *J Hand Surg* 27A:334–343
15. Offenbächer M, Ewert T, Sangha O, Stucki G (2003) Validation of a German version of the 'Disabilities of Arm, Shoulder and Hand' questionnaire (DASH-G). *Z Rheumatol* 62(2):168–177
16. Veehof MM, Slegers EJ, van Veldhoven NH et al (2002) Psychometric qualities of the Dutch language version of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH-DLV). *J Hand Ther* 15:347–354
17. Padua R, Padua L, Ceccarelli E et al (2003) Italian version of the Disability of the Arm, Shoulder, and Hand (DASH) Questionnaire. Cross cultural adaptation and validation. *J Hand Surg* 28B:179–186
18. Liang HW, Wang HK, Yao G et al (2004) Psychometric evaluation of the Taiwan version of the Disability of the Arm, Shoulder, and Hand (DASH) Questionnaire. *J Formos Med Assoc* 103:773–779
19. Lee EW, Chung MM, Li AP et al (2005) Construct validity of the Chinese version of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH-HKPWH). *J Hand Surg* 30B:29–34
20. Orfale AG, Araujo PM, Ferraz MB et al (2005) Translation into Brazilian Portuguese, cultural adaptation and evaluation of the reliability of the Disabilities of the Arm, Shoulder, and Hand Questionnaire. *Braz J Med Biol Res* 38:293–302
21. Themistocleous GS, Goudelis G, Kyrou I et al (2006) Translation into Greek, cross-cultural adaptation and validation of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH). *J Hand Ther* 19:350–357
22. Greenslade JR, Mehta RL, Belward P, Warwick DJ (2004) Dash and Boston questionnaire assessment of carpal tunnel syndrome outcome: what is the responsiveness of an outcome questionnaire? *J Hand Surg* 29(2):159–164
23. Beaton DE, Wright JG, Katz JN, The Upper Extremity Collaborative Group (2005) Development of the Quick DASH: comparison of three item-reduction approaches. *J Bone Joint Surg Am* 87:1038–1046
24. Fayad F, Lefevre-Colau MM, Gautheron V, Mace Y, Fermandian J, Mayoux-Benhamou A, Roren A, Rannou F, Roby-Brami A, Revel M, Poiraudreau S (2008) Reliability, validity and responsiveness of the French version of the questionnaire Quick Disability of the Arm, Shoulder, and Hand in shoulder disorders. *Man Ther* Apr 22
25. Beaton DE, Bombardier C, Guillemin F, Ferraz MB (2000) Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* 25(24):3186–3191
26. Norholm V, Bech P (2001) The WHO quality of life (WHOQOL) questionnaire: Danish validation study. *Nord J Psychiatry* 55:229–235
27. Streiner DL, Norman GR (1998) Health measurement scales. A practical guide to their development and use, 2nd edn. Oxford University Press, Oxford
28. Cronbach LJ (1951) Coefficient alpha and the internal structure of tests. *Psychometrika* 16:297–334
29. Jones SD, Steiner A, Garrett SL, Calin A (1996) The BATH ankylosing spondylitis patient global score (BAS-G). *British J Rheum* 35:66–71
30. Whalley K, Adams J (2009) The longitudinal validity of the quick and full version of the Disability of the Arm, Shoulder, and Hand questionnaire in musculoskeletal hand outpatients. *Hand Ther* 14:22–25
31. Gummesson C, Ward MM, Atroshi I (2006) The shortened disabilities of the arm, shoulder, and hand questionnaire (Quick-DASH): validity and reliability based on responses within the full-length DASH. *BMC Musculoskelet Disord* 7:44
32. Hobby JL, Watts C, Elliot D (2005) Validity and responsiveness of the patient evaluation measure as an outcome measure for carpal tunnel syndrome. *J Hand Surg* 30(4):350–354
33. Matheson LN, Melhorn JM, Mayer TG, Theodore BR, Gatchel RJ (2006) Reliability of a visual analog version of the QuickDASH. *J Bone Joint Surg Am* 88:1782–1787
34. Fan ZJ, Smith CK, Silverstein BA (2008) Assessing validity of the QuickDASH and SF-12 as surveillance tools among workers with neck or upper extremity musculoskeletal disorders. *J Hand Ther* 21:354–365