



## The DASH questionnaire and score in the evaluation of hand and wrist disorders

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**The DASH (Disability of Arm, Shoulder and Hand) score is being used increasingly as an outcome measure for upper limb pathology. In our clinical practice the DASH score has been used to study the outcome of several common upper limb disorders. We reviewed the literature and applied the principles of the World Health Organization on this scoring system.**

### *Principles of evaluation*

Evaluation of the influence of disease and injury on function and health status and evaluation of treatment outcomes are cornerstones of modern medicine. Reliable, reproducible and validated instruments should be used to assess damage due to injury or disease. Reliable evaluation and assessment tools after reconstructive procedures are essential for both the treating surgeon and the insurance companies. The Belgian system of impairment scoring of the hand and wrist is based primarily on restricted motion and sensitivity. Loss of gripping power and pain can add to impairment, but are not quantified (2). Numerous hand and wrist scores have been proposed. These are mostly based on a combination of pain estimation, results of objective measurements, evaluation of function and radiographs. They can be used in scientific studies to compare preoperative and postoperative status, or to compare different techniques or different case series. However critical studies that examine the

validity of these scores to represent the real status of the patient do not exist.

The standardised functional assessment tools used in medical research require sophisticated equipment and trained personnel (occupational therapists) (table Ia). They generally focus on gestures that are considered necessary to perform activities of daily living. However these gestures are often artificial and repetitive and do not therefore equate to daily living performance or functioning. It is not clear whether these tests measure impairment rather than disability.

For most patients pain and limitations in how they live their daily life and interact with others is more important than their degree of impairment, be this expressed as a numerical value (percentage) or as the result of a standardised functional test. More and more consideration has been given to quality of life. With the earliest instruments, clinicians themselves determined the quality of life, but other evaluation instruments gradually appeared, which were completed by the patients. These instruments

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Table Ia. — Standardised hand assessment instruments currently used in evaluation of hand function

Standardised hand assessment instruments
Carroll UEFT
Jebsen hand function test
Minnesota rate of manipulation test
Nine hole peg test
Perdue peg board
Rancho Los Amigos test
Smith hand function test
Sequential occupational dexterity assessment (SODA)
Sollerman hand function test
Hand function index (HFI)
Arthritis hand function test (AHFT)
Take 5 test
Grip ability test

Table Ib. — A list of questionnaires for evaluation of the hand

Self report questionnaires
Patient rated wrist evaluation (PRWE)
Wrist outcome instrument
Injured workers survey
Upper extremity function score
Radoud skills questionnaire
Alderson McGall hand function questionnaire
Brigham carpal tunnel questionnaire
Rheumatoid hand function disability scale
Algofunctional index for OA of the hand
Disabilities arm shoulder and hand (DASH)
Michigan hand outcomes questionnaire (MHQ)
ABILHAND
Manual ability measure
Cochin scale
Patient outcome of surgery - hand/arm

were first designed to measure the quality of life in cancer and other life-threatening conditions, and they were subsequently used for all aspects of health assessment.

Since 1996, patient-completed questionnaires designed to evaluate the hand and upper limb and related domains have been published (table Ib). They are now widely used all over the world. A distinction can be made between the more general generic questionnaires, which grossly measure general health, the domain-specific questionnaires which measure a limited body part or a specific function and the disease-specific questionnaires

which measure the outcome of a specific disorder. All these questionnaires were designed to evaluate disability rather than impairment (1,8,14).

### The WHO (World Health Organisation) directives

The WHO developed a framework to measure health and disease: ICIDH (International Classification of Impairment, Disability and Handicap) (47). Impairment is the abnormal function due to disease or injury (i.e. loss of flexion due to tendon injury). Disability is the lack of ability to perform activities (daily life, work and leisure) due to the impairment (such as not being able to use knife and fork due to the loss of flexion). Handicap is the effect of the disability on social activities (such as loosing your job). The ICF is a recent modification of this ICIDH, which is now widely accepted.

The ICF model makes a distinction between body function (impairment), limitations (disability) and participations (handicap ?); all these elements do interact and are influenced by internal and external situations. It seems obvious that in a modern evaluating system this model should be used (2,5,23,42,45). A model reworked in 2001 is now widely accepted (fig 1).

### THE DASH (Disability of Arm, Shoulder and Hand) score

In 1996 Hudak *et al* (22) published their approach to evaluation of disability: the DASH score, a self-administrated questionnaire which includes 30 items related to functional activities and symptoms in activities of daily living (ADL). The patient is asked to attribute a score of 1 to 5 on all 30 items. Scores rise with increasing disability.

There is also an optional section that contains 4 items relating to disability in athletes and musicians. The raw score obtained is converted into a 0 to 100 scale. The DASH has been extensively investigated with respect to its reliability, repeatability, internal consistency, validity as well as its degree of acceptance in clinical practice (8,10,14,32,39-41,43). It has been used with a wide variety of shoulder, hand,

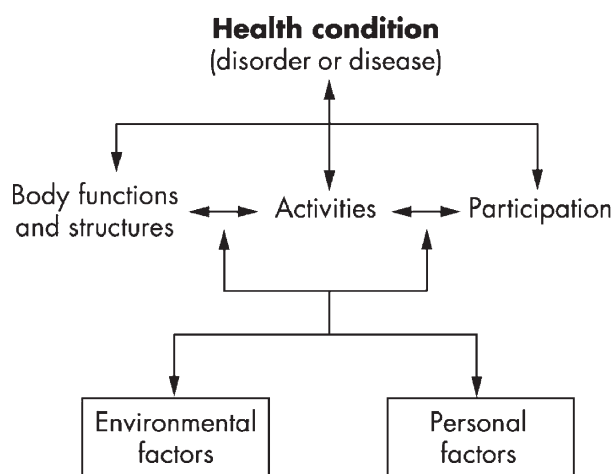


Fig. 1. — Conceptual basis of the ICF model (international classification of functioning disability and health).

elbow and wrist problems. The DASH is regarded as a good instrument for evaluating patients in a general upper limb practice irrespective of diagnosis. It does not contain items on the aspect of the hand. In generalised disorders (34) it may not be considered as sensitive as other specific outcome tools, nor is it as sensitive to change (responsiveness) in generalised pathologies as in more isolated conditions. When the DASH score is analysed more in detail there are however also questions concerning the body function (do you feel weak or stiff,) and participation (social activities) but the majority are on limitations in daily life. The DASH score was also published several years before the ICF model. Although not perfect, it is used all over the world (6), and exists in different validated translations (3,4,11,16,24,30,35-38,44,46,49). The questionnaire can be used for different pathologies, is user friendly and can be completed quickly and easily. The DASH score has been proposed by the AAOS as the standard tool for evaluation of hand and upper limb disability.

A Medline search revealed more than 350 papers using the DASH score in evaluating upper limb pathology and treatment ; it has even been used for disabilities of the lower limb (12).

The normal value for the DASH score in a non clinical population was 10 (SD 14.7) for Hunsaker

Table II. — DASH value of common hand and upper limb disorders. CTS : carpal tunnel syndrome ; CMC OA : carpometacarpal osteoarthritis ; SLAC : scapholunate advanced collapse ; SNAC : scaphoid nonunion advanced collapse ; WRULD : work related upper limb disorders ; N : total number of patients, SD : standard deviation

	Atroshi <i>et al</i> (4) DASH	Our experience	N
		DASH mean (SD)	
Cuff tendinosis	43 (surgical)		
	35 (non surgical)		
Tennis elbow	39	52 (16.2)	215
CTS	40	38 (18.7)	119
CMC OA	48	47 (17.3)	15
Wrist ganglion	11		
Tenosynovitis	36		
Dupuytren	21	15 (14.8)	80
SLAC/SNAC		39 (22.2)	9
Ulnar impaction		42 (19.8)	16
WRULD		50 (12.2)	30

*et al* (23) and 13 (SD 15.0) for Jester *et al* (25). The value of the DASH score in some common hand conditions was studied by Atroshi *et al* (4) and by us (11). The data are summarised in table II.

Drummond *et al* (15) linked the 30 items of the DASH with 63 ICF categories. All of them were in the activities/participation or body function component ; none in the structure or environment component. Since 2001 the DASH score has been introduced in our department and has been used on several occasions to evaluate our daily practice.

### Studies on the validity and responsiveness of the DASH

In order to evaluate the DASH for its validity, we compared the DASH with the PRWE (Patient Rated Wrist Evaluation : a validated wrist score) in a cohort of patients after surgical wrist reconstruction and with the Boston score (31) in patients with carpal tunnel syndrome.

A cohort of 86 patients (68 males and 18 females) operatively treated for several chronic

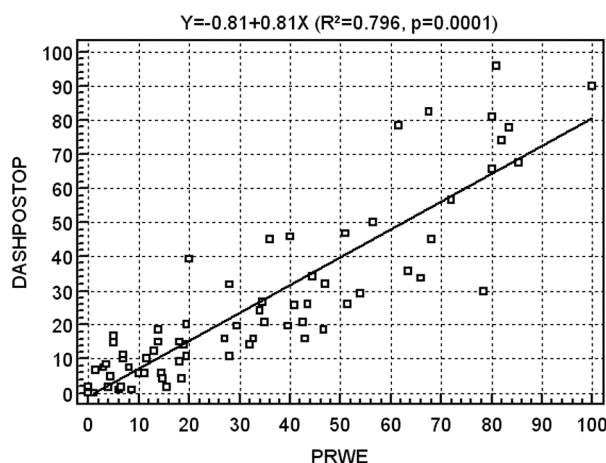


Fig. 2. — Correlation between two outcome scores in chronic wrist pain : DASH (disability of arm shoulder and hand) and PRWE (patient related wrist evaluation).

disorders of the wrist were reviewed and called back. The mean age was 59 years (range, 22 to 84). They all filled in a DASH questionnaire and a PRWE questionnaire (33). All questionnaires were completely filled in. The mean DASH score postoperatively was 24.3 with a SD of 24.7, the mean PRWE was 30.9 with a SD of 27.1. The correlation between PRWE and DASH was highly significant ( $p=0.001$ ). The correlation coefficient was 0.796 with  $DASH = 0.81 + 0.81 \times PRWE$  (fig 2).

A cohort of 119 patients operated for carpal tunnel syndrome were included in another survey. Patients older than 60 years, patients with an arteriovenous fistula, with rheumatoid arthritis or neurological disorders and patients having another ipsilateral surgical procedure were excluded. The DASH score was completed preoperatively and after one year. There were 21 males and 98 females ; the mean age was 51 years (range 26 to 60). At follow-up the patients filled in the DASH questionnaire (22) and also a Boston questionnaire (31). The mean pre-op DASH score was 38.2 (SD 18.7) and it decreased postoperatively to 22.0 (SD 22.8). The Boston score was 20/100 (SD 10) for symptoms and 19/100 (SD 9) for function. The correlation between the DASH postoperatively and both scores of the Boston questionnaire was significant ( $p < .0001$ ) with a correlation coefficient  $r =$

0.78 for the function score and  $R = 0.64$  for the symptom score (9).

We also studied the responsiveness of the DASH score, i.e. its sensitivity to change over time. In other words can a difference after treatment or rehabilitation be seen ? This can be studied by the effect size (mean difference between 2 observations divided by the SD of one of the groups) and the standardised response mean (mean difference between 2 observations, divided by the SD of the differences) (7). It is estimated that the following outcomes :  $< 0.2$  are not responsive ; 0.2 to 0.5 have a small, 0.5 to 0.8 a moderate and  $> 0.8$  a large responsiveness. We studied the value of the DASH score for carpal tunnel release, tennis elbow surgery and arthroplasty/trapeziectomy in carpometacarpal osteoarthritis (table III). MacDermid *et al* (32) reported on responsiveness of the DASH and other outcome scores after distal radial fractures. At 6 months interval, the effect size was 2.52 and the standardised response means (SRM) was 2.32 : this is better than the SF-36 but not as good as the patient rated wrist pain score. Beaton *et al* (6) studied patients with several painful conditions of the hand and wrist (carpal tunnel and tendinitis) and found an effect size of 0.57 and an SRM of 0.74 in the whole group. In patients rating their problem as better at 12 weeks follow-up, the effect size was 0.73 and the SRM was 0.92. They concluded that the responsiveness of the DASH was comparable or better than that of the joint specific measurements. Gay *et al* (17) compared the SF-36, the DASH score and a disease-specific outcome instrument for carpal tunnel release. At 12 weeks postoperative the effect size for the DASH was 1.01 and the SRM was 1.13. They concluded that the DASH score is of sufficient magnitude to be used for clinical use as

Table III. — Effect size and standard response rate in carpometacarpal (CMC) osteoarthritis, tennis elbow (TE) and carpal tunnel syndrome (CTS)

	Effect size	Standard response
CMC	1.27	0.84
TE	2.03	1.54
CTS	0.87	0.69

well as for research purposes. The responsiveness was intermediate between the more general SF-36 and the very specific carpal tunnel outcome instrument. Greenslade *et al* (19) reported on the responsiveness of the DASH and the disease-specific BQ (Boston questionnaire) after carpal tunnel release. The DASH SRM was 0.66, which was marginally higher than the BQ-function SRM of 0.62, indicating higher responsiveness. However, the DASH was less responsive than the BQ-symptoms, which had an SRM of 1.07. Kotsis *et al* (29) found that the DASH was responsive in the assessment of carpal tunnel surgery outcomes. They found an SRM of 0.7, which is in the medium range. Hobby *et al* (21) had more moderate responsiveness with an effect size of 0.49 and SRM of 0.43.

### Correlation between impairment and disability

Although the goal of every treatment is improvement of activities and participation, most evaluation methods focus on the measurement of impairment (loss of body structure and/or function). We are aware of few studies dealing with the correlation between those elements. Jester *et al* (27) found a significant correlation between gripping force and DASH, but not between range of motion and DASH. We studied the outcome of 205 wrist operations. The impairment was expressed in terms of loss of range of motion (ROM) and gripping force, the disability as the DASH score. The DASH score correlated with the gripping force and ROM. For the gripping force the significance was very high and the correlation was 0.47, with or without inclusion of the cohort of patients with a wrist arthrodesis. The correlation between DASH and ROM was less significant and much weaker ( $r = 0.24$ ). In manual workers shorter temporary disability periods were significantly associated with lower DASH score (12).

### CONCLUSION

The DASH questionnaire is an appropriate tool in the evaluation of the wrist and hand. Reliability and reproducibility have been demonstrated in several studies. It has been translated in numerous

languages. Its validity has been proven and the correlation with other outcome scales is high. The DASH fits into the philosophy of the WHO/ICF guidelines. We and others have studied the responsiveness and concluded that this tool is acceptable in outcome studies for most hand and wrist conditions, although not as good as disease-specific outcome tools.

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