Original research article

Pain Intensity and Dominant Arm: Significant Predictors Contributing to the QuickDASH Outcome

Nitaya Viriyathakij*, Teerapat Buapli, Tanisara Yampraserd and Wassana Siriwanitchaphan
Faculty of Physical Therapy, Srinakharinwirot University, Nakhon Nayok 26120, Thailand

Received 6 December 2016; Received in revised form 3 February 2017
Accepted 15 February 2017; Available online 30 June 2017

ABSTRACT

The QuickDASH is an acceptable self-reported questionnaire for upper extremity disability evaluation. Pain and physical activity are two significant domains of the questionnaire. For more precision of the QuickDASH, the effect of dominance of arm in upper extremity musculoskeletal pain was clarified. The Cross-sectional design was conducted in offices in the Bangkok Metropolitan area, and the Ongkarak campus of Srinakharinwirot University. Participants were office workers with or without upper extremity musculoskeletal pain. Main outcomes were Thai QuickDASH disability score and the Numeric Pain Scale (NPS). Of 81.4% respondents, 142 participants returned completed questionnaires. The Spearman correlation coefficient (ρ) for Thai QuickDASH and NPS was 0.648 ($p<0.001$). An adjusted R^2 of 0.406 obtained by multiple regression enabled the prediction of the Thai QuickDASH score based on the NPS and the effect of dominance of arm. The coefficient of pain intensity changed from 3.85(95% CI 3.28, 4.42) to 4.00(95% CI 3.44, 4.57). The coefficient of dominant arm was 5.46(95% CI 2.46, 8.45). Item 5 (difficulty of using a knife to cut food), item 6 (difficulty of recreational activities) and item 9 (rate the severity of arm, shoulder or hand pain) of the Thai QuickDASH were significantly associated with the dominant side (Kendall's rank correlation coefficients $p<0.01$). The standardized coefficient (Beta) revealed that pain intensity was a main factor of the Thai QuickDASH disability outcome. In conclusion, pain intensity and dominant arm are two predictors contributing to the Thai QuickDASH outcome. These associations may help to explain 40% of the variability of disability in upper extremity musculoskeletal pain.

Keywords: pain evaluation; Thai QuickDASH; dominant arm

Introduction

Musculoskeletal pain is a common disorder, and has been extensively reported about in recent decades [1]. It affects the quality of life and daily activity, and causes disturbed mobility [2]. Shoulder pain is the main problem among five sources of pain reported by office workers from computing and typing, and repetitive carrying [3]. The pain areas were localized on the neck (43.5%), shoulder (32.1%)[4] and scapula (37.7%) regions [5]. Scapular

***Corresponding author:** nitayav@g.swu.ac.th **doi:** 10.14456/tijsat.2017.19

pain was significant cause ($p<0.001$) of arm disability, and could be evaluated by the QuickDASH[5].

Any standard outcome measurement tool for shoulder and arm pain must demonstrate its reliability and validity for detecting clinical change. The choice of tool is guided by the purpose of the investigation, the type of information needed and the usefulness of the outcome measures. The QuickDASH is the short version of the Disability of Arm Shoulder and Hand Questionnaire [6]. The highest total score possible is 100 points; higher scores represent greater disability. This instrument consists of 11 questions concerning the domains of pain, physical activity and social factors; these are consistent with the three domains of the International Classification of Function provided by the World Health Organization (WHO), of impairment, activity and participation but excepting the environment domain [7-9]. The psychometric properties of the QuickDASH have been approved in terms of its reliability and validity [10]. Recently, the Thai version of the QuickDASH has been developed by cross-cultural translation [11].

The QuickDASH may be used as a screening tool with a cutoff point of 11.4 points, and can be used with a numeric pain scale (NPS) on a pain location chart [12]. The numeric pain scale is easy to use and results in fewer errors than other pain assessment tools [13, 14]. Its reliability, in terms of intra-class correlation (ICC 2, 1), was 0.74(95%CI 0.08, 0.92) [15]. However, the QuickDASH was designed for the evaluation of upper limb disability that did not imply a dominant or non-dominant side. If it were used to evaluate a dominance effect, this could influence the outcome of the QuickDASH. Thus, the objective of this study was to clarify the effect of dominant arm on QuickDASH outcomes among subjects who presented the upper extremity musculoskeletal pain.

Materials and Methods

A cross-sectional design was used. Two hundred and six participants were recruited from seven offices in the Bangkok Metropolitan area, and three offices in the Ongkarak campus of Srinakharinwirot University (Fig. 1). The offices dealt with insurance business, education, and selling. To be eligible for inclusion, participants were aged between 20-58 years and were good communicators. All participants self-reported the evaluation questionnaire.

This study protocol was ethical as approved by a Human Research Ethics committee of the Health Science Faculty of Srinakharinwirot University (HS2012-0010). Usage permission for the Thai version of the QuickDASH was received from Drs. Jeeranan Rapipong, Montana Buntragulpoontawee and Siam Tongprasert of the Department of Rehabilitation Medicine, Faculty of Medicine, Chiang Mai University, Thailand.

The questionnaire in this study consists of four sections: 1) informed consent, 2) personal and working information, 3) a NPS and pain localization chart (NPS-pain area), and 4) two copies of the Thai version of the QuickDASH questionnaire for each participant, one copy being completed for each arm (dominant and non-dominant).

Data analysis was conducted using completed questionnaires. Uncompleted questionnaires were those in which the NPS had not concurred with the body chart, or had more than one item missing in the QuickDASH. The test-retest reliability of the Thai version of the QuickDASH was assessed from 14 healthy participants. The second session of assessment was conducted three days apart from the first assessment. The intra-class correlation (ICC 2, 1) was 0.838 (95% IC 0.515-0.947). The association between the NPS-pain area and the QuickDASH was tested using the Spearman correlation coefficient. The effect of pain intensity and arm dominance on the

QuickDASH was analysed by multiple regression. Items analysis was performed using Kendall's rank correlation coefficients.

Results and Discussion

Two hundred and six participants signed their informed consent and submitted their questionnaires. The response rate was 81.4% of 253 evaluation questionnaires that were distributed. Accepted as completed questionnaires were 68.9% (142/206) questionnaires, specifically the part of the Thai version of the QuickDASH and NPS-pain area. The complete data set related to a total of 284 arms. Participants' job descriptions comprised computer typing (59 , 41.5 %), managerial work (15, 10.6%), reception (12, 8.4%), finance (10, 7.0%), secretarial work (3, 2.1%), administration (2, 1.4%), drawing (1, 0.7%), IT service (1, 0.7%), sales (1, 0.7%), warehouse duties (1, 0.7%), and not specified (37, 26.0%).

Table 1. Characteristics of eligible participants in this study (n=142).

Data	N	$\bar{X}$ (SD)	Range
Age (yrs.)	141	34.1(7.6)	20.0-58.0
Weight (kg.)	141	59.1(12.1)	35.0-93.0
Height (cm.)	141	160.7(7.6)	145.0-182.0
Working duration (yrs.)	138	7.0(6.8)	0.1-33
	N	n (%)	
Male/Female	142	28(19.7)/114(80.3)	
Dominant arm	142		
Right/Left		132(93.0)/8(5.6)	
Both		2(1.4)	
Arm pain	284		
Yes / No		196 (69.0)/88 (31.0)	

Participants' characteristics are presented in Table 1. The participants had a mean (SD) working duration of 7.0 (6.8) years. Among these participants, 69.0% reported pain in their upper extremity. The demographic data of the 64 uncompleted questionnaires reported a sex ratio (male/female) of 13/23. The dominant arm ratio (right/left/both) was 32/2/1. Age range and mean±SD (years, n=38) was 24-56, 35.7±7.0; weight (Kg, n=37) was 40-100, 60.4±14.4; height (cm, n=38) was 148-177, 161.7±8.3; and working duration (years, n=36) was 0.2-35.7, 7.5±6.8.

The distributions of the QuickDASH and NPS-pain scores from the completed questionnaires are presented in Table 2. The median (95%CI) of the QuickDASH scores was 20.5 (15.9, 22.7) and that of NPS-pain area was 2 (2, 3). The association between pain intensity rated by NPS-pain area and the QuickDASH score, assessed using the Spearman correlation coefficient ρ, was 0.648, p<0.001.

Table 2. The distributions and the association between the Thai QuickDASH score and pain intensity rated by NPS-pain area of all completed questionnaires (n = 142, arm = 284).

Data	Median	95% CI†	Range	ρ‡
QuickDASH (total 100 score)	20.5	15.9, 22.7	0-72.5	0.648* (p<0.001)
NPS-pain area (NPS 0-10)	2.0	2.0, 3.0	0-10	

† 95% Confidence Interval
‡ Spearman correlation coefficient

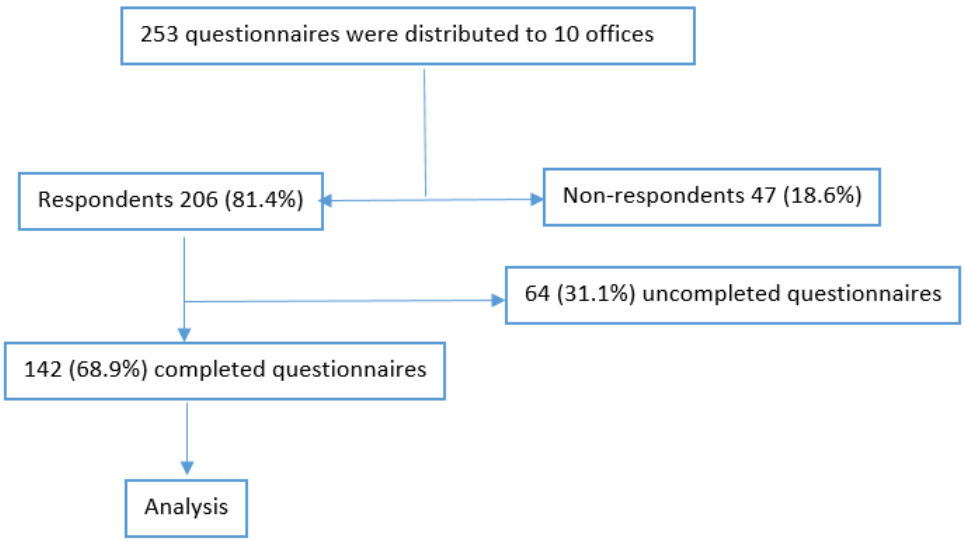

Fig. 1. Flow chart showing response rates of study.

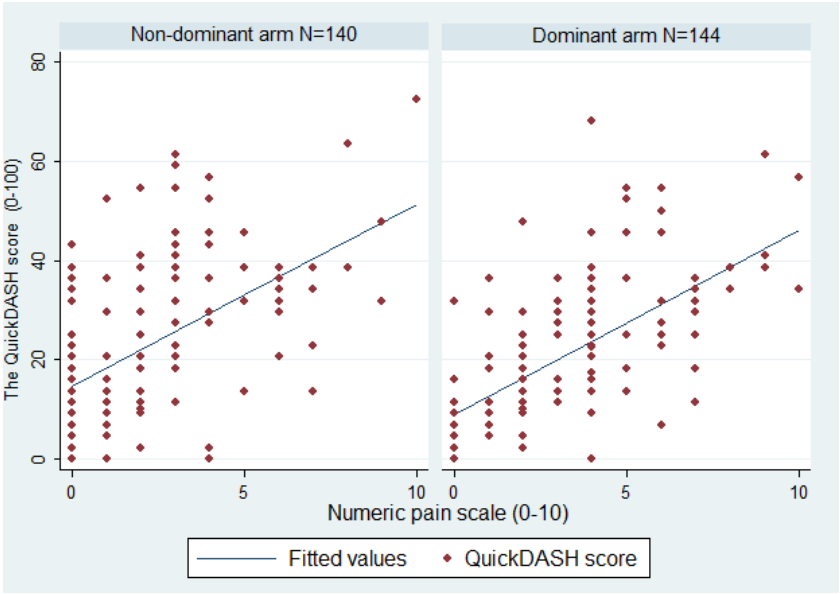

Fig. 2. Correlation between the QuickDASH score and pain intensity rated by Numeric pain scale in non-dominant and dominant arm.

Table 3. Multiple regression analysis to access effect of pain intensity and dominant arm on the Thai QuickDASH score (n=284).

QuickDASH	coefficient	95%CI[†]	Beta	Adj. R^{2}[§]
Pain intensity (NPS)	4.00	3.44, 4.57	0.644	0.406
Dominant arm[‖]	5.46	2.46, 8.45	0.166	

[†] 95% Confidence Interval
[§] Adjusted R-squared from multiple regression analysis
[‖] dominant arm = 0 non-dominant arm = 1

Associations between the subgroups were shown by the scatter plot in Fig. 2. The ρ of the non-dominant arm was 0.601 ($p<0.001$), and that of the dominant arm was 0.748 ($p<0.001$).

The simple regression coefficient of NPS was 3.85 (95%CI 3.28, 4.42); R^2 was 0.384. By adjusted dominance side in multiple regression, the coefficient of the NPS was changed to 4.00 (95%CI 3.44, 4.57); the coefficient of dominance side was 5.46 (95% CI 2.46, 8.45). Adjusted R^2 was 0.406 as in Table 3. The standardized coefficient (Beta) of NPS was 0.644 and dominance side was 0.166. Items analysis is presented in Table 4. Items 5, 6 and 9 were significantly associated with dominance side ($p<0.01$).

Data were obtained from the completed questionnaires from 68.9% (142/206) of acceptable responses. Self-reported pain intensity in the study had controlled variety of each participant by intra-person ratings of symptoms and severity compared between arms. The validity of pain was also confirmed by its existence, its location, its strength by self-localizing pain areas by means of body charts.

Table 4. Items analysis to access effect of arm dominance on the Thai QuickDASH.

	Item	τ ¶	p-value
1	Open a tight or new jar	0.102	0.063
2	Do heavy household chores(e.g. · wash walls, wash floors)	0.010	0.859
3	Carry a shopping bag or briefcase	-0.049	0.384
4	Wash your back	0.061	0.272
5	Use a knife to cut food	0.346	>0.001*
6	Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g. golf, hammering, tennis, etc.)	0.145	0.007*
7	During the past week, to what extent has your arm, shoulder hand problem interfered with your social activities with family, friends, neighbors or groups?	-0.079	0.154
8	During the past week, were you limited in your work or other regular daily activities as a result of your limited arm, shoulder or hand problem?	-0.023	0.684
	Please rate the severity of the following symptoms in the last week		

9	Arm, shoulder or hand pain	-0.178	0.001*
10	Tingling (pins and needles) in your arm, shoulder or hand	-0.084	0.134
11	During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand?	-0.062	0.270

¶ Kendall's rank correlation coefficients

The psychometric properties of the Thai version of the QuickDASH, including high test-retest reliability, was represented (ICC 2, 1 0.838; 95%CI 0.515-0.947) [12]. This level of reliability was similar to a previous study that was within a range of 0.87-0.94[10].

This study found a significant, moderate association [16] between pain intensity and disability (ρ 0.648; $p<0.001$). The standardized coefficient (Beta) of NPS in this study was also consistent in pain intensity at the most common domain in the shoulder, the same as in a previous measurement tool [17]. Thus, at the same pain intensity, the disability score, particularly in the non-dominant arm, may differ in the predicted QuickDASH results. The score of non-dominant arm may higher 5.46 scores compared with the dominant arm. Pain intensity and dominant arm are two predictors contributing to disability outcome. Recently, the dominant limb in patients with upper extremity conditions in the multivariable analysis model with diagnosis, region, and sex had significantly higher DASH scores, but accounted approximately 10 % (adjusted R^2= 0.096) of the variability in DASH scores [18] . The present study also clarified a significant association between the QuickDASH score and the dominant arm. The association may explain 40% (adjusted R^2= 0.406 from this study) of the variability in the Thai QuickDASH in musculoskeletal arm pain. However, in a condition of low level musculoskeletal pain in this study, the pain intensity ranged between 2-3 points which may be limitation of this study, and needs more study in the future.

Conclusions

Pain intensity has an increased contribution to the disability outcome. According to the dominant effect, a person with musculoskeletal pain in the non-dominant arm will rate higher QuickDASH scores or more disability than for the dominant arm. The Thai version of the QuickDASH questionnaire is possibly suitable for evaluation of disability in upper extremity musculoskeletal pain, especially when evaluated in parallel with an NPS. The interpretation of improvement or effectiveness of treatment, should take into account the effect of the dominant arm.

This is from multiple regression

Acknowledgements

We are thankful to all participants for taking part in this study, and Assistant Professor Junya Pattaraarchachai for consultation on statistics.

References

[1] Buckle PW, Jason DJ. The nature of work-related neck and upper limb

musculoskeletal disorders. Appl Ergon 2002;33:207-17.

[2] Gutierrez DD, Thompson L, Kemp B, Mulroy SJ. The relationship of shoulder pain intensity to quality of life, physical activity, and community participation in persons with paraplegia. J Spinal Cord Med 2007;30:251-5.

[3] Strom V, Roe C, Knardahl S. Work-induced pain, trapezius blood flux, and muscle activity in workers with chronic shoulder and neck pain. Pain 2009;144:147-55.

[4] Mekhora, K. The effect of ergonomic intervention on discomfort in computer users with tension neck syndrome. Int J Ind Ergon 2000;26:367-79.

[5] Vriyatharakij N, Wangyapongsataporn K, Charoensuksiri S, Wuttimetha S. Ability of arm in condition of pain and non scapular muscle pain. Thai J Phys Ther 2013;35:148-56.

[6] Beaton DE, Wright J, Katz J. Development of the QuickDASH: Comparison of Three Item-reduction Approaches. J Bone Jt Surg 2005;87A:1038-46.

[7] Dixon D, Johnston M, McQueen M, Court-Brown C. The Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) can measure the impairment, activity limitations and participation restriction constructs from the International Classification of Functioning, Disability and Health (ICF). BMC Musculoskelet Disord. 2008;9:114.

[8] Silva DA, Ferreira SR, Cotta MM, Noce KR. Stamm TA. Linking the Disabilities of Arm, Shoulder, and Hand to the International Classification of Functioning, Disability, and Health. J Hand Ther. 2007;20:336-43

[9] Roe Y, Soberg HL, Bautz-Holter E, Ostensjo S. A systematic review of measures of shoulder pain and functioning using the International classification of functioning, disability and health (ICF). BMC Musculoskelet Disord 2013;14:73.

[10] Kennedy CA, Beaton DE, Smith P, Eerd DV, Tang K, Inrig T, et al. Measurement properties of the QuickDASH (disabilities of the arm, shoulder and hand) outcome measure and cross-cultural adaptations of the QuickDASH: a systematic review. Qual Life Res 2013;22:2509-47.

[11] Tongprasert S , Rapipong J , Buntragulpoontawee M. The cross-cultural adaptation of the DASH questionnaire in Thai (DASH-TH). J Hand Ther 2014;27:49-54.

[12] Viriyatharakij N , Buapli T , Yampraserd T , Siriwanitchaphan, W. Upper extremity pain evaluation with Thai version of QuickDASH and numeric pain scale in office workers. J Heal Res 2016;30:47-51.

[13] Ferreira-Valente M A, Pais-Ribeiro J L, Jensen MP. Validity of four pain intensity rating scales. Pain 2011;152:2399-404.

[14] Hjermstad MJ, Fayers PM, Haugen DF, Caraceni A, Hanks GW, Loge JH, et al. Studies Comparing Numerical Rating Scales, Verbal Rating Scales, and Visual Analogue Scales for Assessment of Pain Intensity in Adults: A Systematic Literature Review. J Pain Symptom Manage 2011;41:1073-93.

[15] Mintken PE, Glynn P, Cleland JA. Psychometric properties of the shortened disabilities of the Arm, Shoulder, and Hand Questionnaire (QuickDASH) and Numeric Pain Rating Scale in patients with shoulder pain. J Shoulder Elbow Surg 2009;18:920-6.

[16] Portney LG, Watkins P. Foundations of Clinical Research: Applications to Practice. 3rd ed. New Jersey: Pearson Education, Inc; 2009. P 525.

[17] Page MJ, McKenzie JE, Green SE, Beaton DE, Jain NB, Lenza M, et al. Core domain and outcome measurement sets for shoulder pain trials are needed: systematic review of physical therapy trials. J Clin Epidemiol 2015;68:1270-1281.

[18] Kachooei AR, Moradi A, Janssen SJ. Ring D, The influence of dominant limb involvement on DASH and QuickDASH. Hand (N Y)2015; 103:512–515.