Title: **Reliability and validity of the Japanese-language version of the Physical Performance Test (PPT) Battery in chronic pain patients**

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Abstract

Purpose: To prepare a Japanese-language version of the Physical Performance Test (PPT) Battery and assess its reliability and validity.

Method: Activity limitations by pain were evaluated by means of the Japanese-language version of the PPT Battery in 82 patients with chronic pain in the limbs and trunk. Two self-report questionnaires, one related to sensory evaluation of pain, and the other related to affective evaluation of pain, and the Functional Independence Measure (FIM), which evaluates activities of daily living, were simultaneously administered to the subjects.

Results: The results for reliability showed that the ICC values for inter-rater reliability and intra-rater reliability were 0.91 or more for every item. The results for validity showed significant associations between the scores for all of the items on the Japanese-language version of the PPT Battery and the total scores on the FIM ($p < 0.01$). Significant associations were found between 5 of the 8 items on the Japanese-language version of the PPT Battery and affective state due to the pain.

Conclusions: The Japanese-language version of the PPT Battery was shown to possess adequate reliability and validity as a scale for evaluating the activity limitations of patients with chronic limb or trunk pain. The results also suggested that it might be possible to improve the activity limitations of patients with chronic pain by improving their affective state in response to the pain.

Introduction

Clinical evaluations of chronic pain patients in rehabilitation have traditionally been conducted on the basis of evaluations of body functions and body structures in the International Classification of Function, Disability, and Health (ICF) of the World Health Organization (WHO),[1, 2] and the results of the evaluations have often been used to estimate activity limitations.[3] In other words, evaluations of the body functions and body structures of chronic pain patients have been substituted for evaluations of the pain itself, and rehabilitation program planning and efficacy ratings have often been based on them.[4] However, since the impairments of chronic pain patients are affected by psychological, social, and environmental factors, not just body functions or body structures, activity limitations cannot be predicted on the basis of the results of evaluations of body functions and body structures alone.[5 - 9] Moreover, while the problem of body functions and body structures may represent the primary problem for caregivers, for patients the activity limitations are often the major problem in terms of daily living. Thus, in the rehabilitation of chronic pain patients, instead of just evaluations of body functions and body structures based on physiological measurements, it is preferable to make objective evaluations and improvements in activity limitations based on physical performance tests and objective tests that evaluate activity limitations and whose reliability and validity have been established are essential to achieving this aim.

Several physical performance measurements have been developed in the past as indices to evaluate activity limitations.[10 - 13] Everyday actions were used as the tasks, and times and distances required to perform them were measured. However, although the reliability and validity of several of these measurements of physical performance have been reported for elderly people,[14, 15] reliability and validity have seldom been reported for patients with pain.[16]

Moreover, since no tests to measure the physical performance of chronic pain patients are available in Japan at the present time, adequate objective evaluation of activity limitations is not being performed. Nevertheless, the Physical Performance Test (PPT) Battery created by Simmonds et al.[17] can be cited as a test battery devised for the purpose of measuring the physical performance of chronic pain patients. It was devised in 1998 in the United States, and its reliability and validity in cancer patients[18] and low back pain patients[19 - 22] have been established. The tasks included in the PPT Battery are characterized by being affected by pain, ease of measurement of physical performance, and requiring hardly any special equipment.

The purpose of the present study was to prepare a Japanese-language version of the PPT Battery and assess its reliability and validity. If the reliability and validity of the Japanese-language version of the PPT Battery were demonstrated by this study, it would be possible to objectively evaluate the activity limitations of chronic pain patients and would enable an effective rehabilitation approach with the goal of improving activity limitations and secondary pain relief.

Methods

SUBJECTS

The subjects of this study were 82 patients with chronic pain in the limbs or trunk who were utilizing the services of the orthopedic outpatient clinic and attending outpatient rehabilitation, and who met the following eligibility criteria: (1) chronic limb or trunk pain, (2) 18 years of age or older, (3) informed consent given; and exclusion criteria: (1) serious physical condition and inability to tolerate the survey, (2) pain other than pain of the limbs or trunk (musculoskeletal pain), (3) difficulty in walking (use of a walking aid was permissible),

(4) difficulty understanding the purpose of the study.

MEASURES

(1) Sociodemographic and medical factors

Information on age, gender, body height, body weight, diagnosis, complications, whether orthopedic surgery had been performed, and pain (site, duration) was collected from the chart.

(2) Degree of physical performance: Physical Performance Test (PPT) Battery

The PPT Battery was devised by Simmonds et al.[17] in 1998 to measure the degree of motor performance of patients with pain. It was modified for cancer patients[18] and low back pain patients,[19 - 22] and its reliability and validity have been demonstrated.[17, 18] The PPT Battery consists of 8 items in which upper limb movement and whole-body movement are executed in a sitting and standing position, and time and distance are measured. The tasks are as following: 15-meter walk at fastest speed (PPT1), Forward reach (PPT2), Timed, repeated sit-to-stand (PPT3), Sock test (PPT4), Timed, repeated reach-up (PPT5), Timed belt tie (PPT6), Distance walked in 6 minutes (PPT7), and Coin test (PPT8).

After obtaining copyright permission to create a Japanese-language version of the PPT Battery from the author of the original version, we translated the PPT Battery into Japanese. The Japanese version of the PPT Battery was developed after a process of back-translation by a colleague who is a native speaker of English and fluent in Japanese.

(3) Pain: Numerical Rating Scale (NRS)

The NRS is a type of visual analogue scale (VAS) that evaluates pain, and was proposed by Keel in 1948. The NRS allows patients to express the degree of pain or discomfort they

experience in numerical form, and it has been shown to be reliable and valid.[23, 24] In accordance with previous studies, two different aspects of pain were evaluated in the present study.

1) Pain intensity: Numerical Rating Scale (NRS1)

A straight line 10 cm long is drawn, and patients are asked to assume that “0” represents a state of “no pain” and “10” represents a state of the “worst possible pain”, and then to select the step that best represents their state from the 11 numbered steps.

2) Pain affect/unpleasantness: Numerical Rating Scale (NRS2)

A straight line 10 cm long is drawn, and patients are asked to assume that “0” represents a state of no unpleasantness at all associated with the pain (not unpleasant) and “10” represents a state of the worst unpleasantness possible (extremely unpleasant), and then to select the step that best represents their state from the 11 numbered steps.

(4) Activities of daily living (ADL): Functional Independence Measure (FIM)

The FIM is a scale that has been used in practice in the United States since 1987 as a means of uniformly recording the severity of activity limitations and the efficacy of rehabilitation therapy.[25] It is composed of 18 items, comprising 6 self-care items, 3 mobility items, 2 locomotion items, 2 sphincter control items, 2 communication items, and 3 social cognition items. Function level is evaluated on a scale composed of a total of 7 steps, comprising 2 independence steps, 3 modified dependence steps, and 2 complete dependence steps. The highest score for each item is 7 points, and the lowest score is 1 point. Possible total scores for all 18 items range from 18 to 126 points, with higher scores meaning a higher evaluation of ADL ability. The Japanese version has also been standardized. [26]

EVALUATION PROCEDURE

The following procedure was used to conduct the evaluations:

(1) The NRS1, NRS2, and FIM were administered before performing the evaluation by the PPT Battery.

(2) The items in the PPT Battery were administered in random order (except that the 6-minute-walk test was always performed last), and the 2 raters (an occupational therapist and a physiotherapist) rated each subject at the same time.

(3) With not exacerbating the subjects' symptoms as a precondition, the subjects were told to perform the item as quickly as possible, or as far as possible. In order to reduce the impact of other signs, such as fatigue, feeling tired, etc., the patients were allowed to rest after each task had been completed.

(4) Pain was measured at the end of the PPT Battery, and it was judged whether the tests had exacerbated the pain or any other symptoms,

(5) The entire procedure was repeated about 2 weeks later.

During the conduct of the Japanese-language version of the PPT Battery, the subjects were instructed to perform the actions as quickly as possible, or as far as possible, but the actions were adjusted by the patients according to the severity of their pain. Care was taken to prevent fatigue by allowing adequate rest between the tasks and during each task, and the task that caused the greatest buildup of fatigue, the 6-minute walk, was always performed last.

DATA ANALYSIS

Reliability was evaluated on the basis of inter-rater reliability and intra-rater reliability. Inter-rater reliability was assessed by using the intraclass correlation coefficient (ICC) to test for agreement between the results of the PPT Battery measurements by the two raters.

Intra-rater reliability was assessed by using the ICC to test the reproducibility of the measurements of the Japanese-language version of the PPT Battery made by a single rater. Validity was evaluated by using Spearman's rank correlation coefficient to test the correlation between the results for each of the subscales of the PPT Battery and the total FIM scores. Factors associated with each of the items of the Japanese-language version of the PPT Battery were identified by using Spearman's rank correlation coefficient or the Mann-Whitney *U*-test to calculate associations between the Japanese-language version of the PPT Battery and other factors.

ETHICS CONSIDERATIONS

In conducting this study, the aim and methods of the study, the fact that it was possible to refuse to continue to participate in the survey at any time, that there would be no disadvantages in terms of treatment as a result, and that privacy would be strictly maintained was explained to the subjects according to the content of the explanatory document, and only those from whom written consent to participate were obtained were enrolled in the study. The PPT Battery measurements were made after detailed cautioning of the subjects so that no physical risks or exacerbation of the pain would occur.

Results

SOCIODEMOGRAPHIC AND MEDICAL FACTORS

There were 82 subjects who fulfilled the eligibility criteria and gave their consent in writing (17 men, 20.7%; 65 women, 79.3%), and their mean age was 82.3 ± 8.4 years (range: 54-97 years). The severity of the pain was relatively mild (NRS1: 2.9 ± 1.6), and the major

sites of pain were widely distributed in various parts of the body. Although 60 subjects (73.2%) used walking aids, such as a cane or walker, all of the subjects were capable of walking independently, and none of them required a high level of assistance to walk. The mean scores on the scales were: FIM, 95.3 ± 12.7 (range: 74-121); NRS1, 2.9 ± 1.6 (range: 1-7); NRS2, 2.9 ± 1.7 (range: 1-8) (Table 1).

ASSESSMENT OF ADVERSE EVENTS

There was no exacerbation of the pain by the measurements after performing the Japanese-language version of the PPT Battery, and there were no changes in the NRS1 ratings, which were used as pain evaluation scales. No exacerbation of the physical symptoms, no increases in mental distress, and no effect of fatigue on any of the tasks was observed. Because the first evaluation included an oral explanation and demonstrations, whenever necessary, the measurement time was 20 minutes for the fastest subject and 35 minutes for the slowest subject, whereas during the re-evaluations the measurement time was 13 minutes for the fastest subject and 27 minutes for the slowest subject, and the measurements did not require a long time.

RELIABILITY

The results of each test in the Japanese-language version of the PPT Battery for each rater are shown in Table 2.

(1) Inter-rater reliability

The ICC values for agreement between the results of the measurements of each of the items in the Japanese-language version of the PPT Battery by the two raters ranged from

0.997 to 1.000 (Table 3).

(2) Intra-rater reliability

The ICC values for agreement between the results of the measurements of each of the items in the Japanese-language version of the PPT Battery by the same rater on two different occasions ranged from 0.919 to 0.993 (Table 3).

VALIDITY

Significant associations were found between the scores for all items on the Japanese-language version of the PPT Battery and the total scores on the FIM, which was used to evaluate ADL (Table 4).

ASSOCIATIONS BETWEEN THE JAPANESE-LANGUAGE VERSION OF THE PPT BATTERY AND OTHER FACTORS

The results of the univariate analysis performed in an attempt to identify factors associated with the results of the Japanese Version of the PPT Battery showed that NRS1, NRS2, age, gender, and whether a walking aid was used were significantly associated with PPT1; NRS1 and NRS2, with PPT2; age with PPT3; and whether a walking aid was used, with PPT4. In addition, NRS1 and NRS2 were significantly associated with PPT5; age, with PPT6; NRS1, NRS2, age, and whether a walking aid was used, with PPT7; and NRS2, with PPT8 (Table 5).

Discussion

Chronic pain in the trunk and limbs limits activity, and the activity limitations cause psychological and social distress, decrease QOL, and increase the burden on the patient and the family. Because of this, improving activity limitations is one of the goals of rehabilitation, and appropriate evaluation of the activity limitations and judging the efficacy of treatment are essential to the process. In that sense, the PPT Battery is considered a useful means of more accurately perceiving the activity limitations of chronic pain patients and better managing their pain. Accordingly, in this study we prepared a Japanese-language version of the PPT Battery, and the tests we performed to demonstrate its reliability and validity yielded favorable results.

FEASIBILITY OF THE JAPANESE VERSION OF THE PPT BATTERY

All of the subjects were able to perform all of the tasks in the Japanese-language version of the PPT Battery used in this study. It was also easy for the raters to make the measurements and interpret the results, and they never found it difficult to arrive at their judgments. Resting was included during PPT7 (6-minute walk) and it was explained to the subjects that they themselves could adjust and decide the degree to which they performed the action in PPT5 (raising both arms) according to their level of fatigue and pain. These were thought to be the reasons why the subjects were not subjected to major burdens. Use of walking aids was permitted during the walking task as a safety precaution, and since the conditions under which the measurements were made, i.e., hospital space, path walked, and equipment, such as chairs and desks, were made uniform, no problems were observed. Moreover, none of the subjects refused to perform the tasks during the examination process, none were incapable of

completing them all, none had such severe problems in the manner of performing them that the measurements could not be made, and there was never any exacerbation of the pain after the measurements.

Based on these findings the Japanese-language version of the PPT Battery appeared to be an evaluation method that could be conducted without exposing the subjects to major burdens or adverse events.

RELIABILITY OF THE JAPANESE-LANGUAGE VERSION OF THE PPT BATTERY

The ICC values for inter-rater reliability and intra-rater reliability were 0.91 or more for all of the items in the Japanese-language version of the PPT Battery. In previous studies the ICC values for intra-rater reliability were reported to be lower for tasks that included complicated actions (PPT6: 0.78; PPT8: 0.69) than for other tasks,[17] but no large decreases in ICC values were observed in the present study (PPT6: 0.954; PPT8: 0.960). Eliasziw et al[27] reported that if an ICC value is in the 0.81-1.00 range, agreement can be judged to be almost perfect, i.e., that the evaluations are almost exactly the same. Thus, the results of this study showing that the ICC values for inter-rater reliability were all 0.99 or more showed extremely strong agreement between the two raters of the Japanese-language version of the PPT Battery. In addition, the results showing that the ICC values for intra-rater reliability were all 0.91 or more demonstrated extremely strong agreement between the results obtained by the same rater (reproducibility of the evaluations) of the Japanese-language version of the PPT Battery.

The above findings suggest that there are no problems with the reliability of the Japanese-language version of the PPT Battery. Its reliability, i.e., the confirmation of the stability of the Battery, means that reliable results are obtained even when the Battery is performed just one time. These results support the findings in several previous studies[14 - 17]

that have reported that physical performance tests are reliable. Because the tasks on the PPT Battery are familiar actions that are similar to ADL, it is easy for patients to carry them out without any special training. Moreover, because the equipment and methods used to make the measurements are convenient, it is also easy for physicians to use clinically. As a result of these features, the PPT Battery seems to have been shown to have high reliability in this study as well.

VALIDITY OF THE JAPANESE-LANGUAGE VERSION OF THE PPT BATTERY

The Pain Disability Index,[28] Modified Oswestry Low Back Pain Disability Questionnaire,[29] and Roland and Morris Disability Questionnaire[30 - 32] have been developed as batteries to evaluate the impaired performance of pain patients, and their reliability and validity have mainly been demonstrated in the United States.[33 - 38] However, these tests are self-report questionnaires and may be influenced by mismatches of perception and assumptions regarding pain and limitations of activity impaired by it. For these reasons, the abilities that subjects think that they possess in regard to ADL and the abilities that they actually possess have been reported to not always match.[22] Moreover, although almost all of these tests were designed to evaluate low back and leg pain patients, since the present study was not limited to pain in the low back or lower limbs, we thought that it was inappropriate to use them as tests to assess the validity of the Japanese-language version of the PPT Battery.

The validity of the original version was demonstrated by showing strong correlations between the PPT Battery and the Functional Status Index (FSI). However, because no Japanese-language version of the FSI exists, we used the FIM, a test that is widely used in Japan to measure activity limitations in ADL, to assess associations with the Japanese-language version of the PPT Battery. Since the results showed significant

correlations between all of the items on the Japanese-language version of the PPT Battery and total scores on the FIM, the Japanese-language version of the PPT Battery appears to possess sufficient validity to evaluate the activity limitations of chronic pain patients.

FACTORS RELATED TO EACH ITEM OF THE JAPANESE-LANGUAGE VERSION OF THE PPT BATTERY

The NRS2 score, i.e., an affective evaluation of pain, was extracted as a factor that was significantly associated with 5 of the 8 PPT Battery items, suggesting that mood or affective state may impair ADL more than the pain itself or the way it is felt. Some previous studies have reported that the psychological suffering caused by the pain of chronic pain patients is more strongly associated with activity limitations than the pain itself,[39] and others have reported that improving the activity limitations of chronic pain patients relieves patients' psychological suffering and that their psychological adjustment promotes the improvement in activity limitations, [40] and thus the results of the present study support the findings of those studies.

Associated factors in addition to the NRS2 score consisted of age, which was identified as a factor associated with 4 items, and whether a walking aid was used, which was associated with 3 items. These results suggest that the age of the subject and whether the subject uses a walking aid need to be taken into consideration when conducting evaluations based on the results of measurements of each of the items in the Japanese-language version of the PPT Battery.

LIMITATION AND PERSPECTIVES

The first limitation of this study is that the diseases that caused the chronic pain of the

subjects in this study were restricted to the musculoskeletal system. Since chronic pain is considered a major symptom of cancer and other intractable diseases and there are other diseases in which ADL is impaired by it, it is unclear whether the results of this study can be applied to other diseases. The second limitation that can be cited is that the 82 subjects consisted of 65 women and only 17 men, and thus there was gender bias. The bias seems to be attributable to the fact that more women were attending the institutions whose cooperation was obtained in this study and that the same tendency existed among the subjects from whom consent was obtained. Gender was not identified as an associated factor in the Japanese-language version of the PPT Battery according to the results of this study, but since significant differences in the results according to gender have been found in previous studies that used other performance tests of ADL in low back pain patients, [21] gender seems to need to be taken into consideration as a factor in future research. The third limitation that can be pointed out is that the subjects were limited to a single institution, and thus the results of the study cannot be generalized to all similar patients in other areas or institutions. Finally, based on the results of this study, the factors that impair ADL are mood and affect influenced by the pain more than the pain itself or how the pain is felt. Nevertheless, since this was a cross-sectional study, it is impossible to say whether the affective state resulting from the pain impaired the ADL or the impairment of ADL due to the pain influenced the subjects' affective state.

Based on the above, in the future we wish to assess the validity of the Japanese-language version of the PPT Battery in other patients whose major symptom is chronic pain, and then assess the mid- to long-term efficacy of intervention by a rehabilitation approach that includes improvement of the affective state due to the pain rather than an approach whose only purpose is to alleviate the pain itself.

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References

[1] Fordyce WE, Lansky D, Calsyn DA, Shelton JL, Stolov WC, Rock DL. Pain measurement and pain behavior. *Pain* 1984, 18: 53-69.

[2] White J, Strong J. Measurement of activity levels in patients with chronic pain. *Occupational Therapy Journal of Research* 1992, 12: 217-228.

[3] Jette AM, Smith K, Haley SM, Davis KD. Physical therapy episodes of care for patients with low back pain. *Physical Therapy* 1994, 74: 101-110.

[4] Blakeney AB. Occupational therapy intervention in chronic pain. In: Cromwell FS (ed) Occupational therapy and the patient with pain. New York: Haworth Press, 1984; 43-54.

[5] Simmonds MJ, Kumar S, Lechelt E. Psychosocial factors in disabling low back pain: cause or consequences? *Disability and Rehabilitation* 1996, 18: 161-168.

[6] Slater MA, Hall HF, Atkinson JH, Garfin SR. Pain and impairment beliefs in chronic low back pain: validation of Pain and Impairment Relationship Scale(PAIRS). *Pain* 1991, 44: 51-56.

[7] Lacker JM, Carosella AM, Feuerstein M. Pain expectancies, pain, and functional self-efficacy expectancies as determinants of disability in patients with chronic low back disorders. *Journal of Consulting and Clinical Psychology* 1996, 64: 212-220.

[8] Kaplan GM, Wurtele SK, Gillis D. Maximal effort during functional capacity evaluations: an examination of psychological factors. *Archives of Physical Medicine and Rehabilitation* 1996, 77: 161-164.

[9] Waddell G, Main CJ, Morris EW, DiPaola M, Gray ICM. Chronic low-back pain, psychological distress and illness behavior. *Spine* 1984, 9: 209-213.

[10] Lindstrom I, Ohlund C, Nachemson A. Physical performance, pain, pain behavior and

subjective disability in patients with subacute low back pain. *Scandinavian Journal of Rehabilitation Medicine* 1995, 27: 153-160.

[11] Mayer TG, Gatchel RJ, Kishino N, et al. Objective assessment of spine function following industrial injury. A prospective study with comparison group and one-year follow-up. *Spine* 1985, 10: 482-493.

[12] Mayer TG, Gatchel RJ, Kishino N, et al: A prospective short-term study of chronic low back pain patients utilizing novel objective functional measurement. *Pain* 1986, 25: 53-68.

[13] Fisher K, Johnston M. Validation of the Oswestry Low Back Pain Disability Questionnaire, its sensitivity as a measure of change following treatment and its relationship with other aspects of the chronic pain experience. *Physiotherapy Theory and Practice* 1997, 13: 67-80.

[14] Reuben DV, Siu AL. An objective measure of physical function of elderly outpatients: the Physical Performance Test. *Journal of the American Geriatric Society* 1990, 38: 1105-1112.

[15] Duncan PW, Weiner DK, Chandler J, Studenski S. Functional reach: a new clinical measure of balance. *Journal of Gerontology* 1990, 45: 192-197.

[16] Harding VR, Williams AC, Richardson PH, et al. The development of a battery of measures for assessing physical functioning of chronic pain patients. *Pain* 1994, 58: 367-375.

[17] Simmonds MJ, Olson SL, Jones S, et al. Psychometric characteristics and clinical usefulness of physical performance tests in patients with low back pain. *Spine* 1998, 23: 2412-2421.

[18] Simmonds MJ. Physical function in patients with cancer: psychometric characteristics and clinical usefulness of a Physical Performance Test Battery. *Journal of Pain and Symptom Management* 2002, 24: 404-414.

[19] Filho IT, Simmonds MJ, Protas EJ, Jones S. Back pain, physical function, and estimates of aerobic capacity: what are the relationships among methods and measures? American *Journal of Physical Medicine and Rehabilitation* 2002, 81: 913-920.

[20] Novy DM, Simmonds MJ, Lee CE. Physical performance tasks: what are the underlying constructs? *Archives of Physical Medicine and Rehabilitation* 2002, 83: 44-47.

[21] Novy DM, Simmonds MJ, Olson SL, Lee CE, Jones SC. Physical performance: differences in men and women with and without low back pain. *Archives of Physical Medicine and Rehabilitation* 1999, 80: 195-198.

[22] Lee CE, Simmonds MJ, Novy DM, Jones SC. Self-reports and clinician-measured physical function among patients with low back pain: A comparison. *Archives of Physical Medicine and Rehabilitation* 2001, 82: 227-231.

[23] Bercker M, Hughes B. Using a tool for pain assessment. Nursing Times 1990, 86: 50-52.

[24] Mineda Y, Totoki T, Harano K. Assessment of pain in pain clinics {Japanese). *Journal of Pain Clinic* 1986, 7: 577-584.

[25] Hamilton BB, Laughlim JA, Fiedler RC, Granger CV. Interrater reliability of the 7-level functional independence measure (FIM). *Scandinavian Journal of Rehabilitation Medicine* 1994, 26: 115-119.

[26] Yamamoto M, Sonoda S, Hayashi T. New evaluation method of ADL - Functional Independence Measure (FIM) – (Japanese). *Japanese Journal of Nursing Techniques* 1992, 38: 922-925.

[27] Eliasziw M, Young SL, Woodburg MG, Fryday-Field K. Statistical methodology for the concurrent assessment of interrater and interrater reliability: using goniometric measurements as an example. *Physical Therapy* 1994; 74: 777-788.

[28] Tait RC, Pollard CA, Margolis RB, Duckro PN, Krause SJ. The Pain Disability Index.

psychometric and validity data. *Archives of Physical Medicine and Rehabilitation* 1987, 68: 438-441.

[29] Fritz JM, Irrgang JJ. A comparison of a modified Oswestry Low Back Pain Disability Questionnaire and the Quebec Back Pain Disability Scale. *Physical Therapy* 2001, 81: 776-788.

[30] Delitto A. Are measures of functional and disability important in low back care? *Physical Therapy* 1994, 74: 452-262.

[31] Beurskens AJ, de Vet HC, Koke AJ, et al: Measuring the functional status of patients with low back pain. Assessment of the quality of four disease-specific questionnaires. *Spine* 1995, 20: 1017-1028.

[32] Deyo RA, Battie M, Beurskens AJHM, et al. Outcome measures for low back pain research: a proposal for standardized use. *Spine* 1998, 23: 2003-2013.

[33] Deyo RA, Centor RM. Assessing the responsiveness of functional scales to clinical change: an analogy to diagnostic test performance. *Journal of Chronic Disease* 1986, 39: 897-906.

[34] Jensen MP, Strom SE, Turner JA, Romano JM. Validity of the Sickness Impact Profile Roland scale as a measure of dysfunction in chronic pain patients. *Pain* 1992, 50: 157-162.

[35] Patrick DL, Deyo RA, Atlas SJ, Singer DE, Chapin A, Keller RB. Assessing health-related quality of life in patients with sciatica. *Spine* 1995, 20: 1899-1908.

[36] Stratford PW, Binkley J, Solomon P, Gill C, Finch E. Assessing change over time in patients with low back pain. *Physical Therapy* 1994, 74: 528-533.

[37] Beurskens AJ, de Vet HC, Koke AJ. Responsiveness of functional status in low back pain: a comparison of different instruments. *Pain* 1996, 65: 71-76.

[38] Riddle DL, Stratford PW, Binkley JM. Sensitivity to change of the Roland-Morris Back

Pain Questionnaire: Part 2. *Physical Therapy* 1998, 78: 1197-1207.

[39] Rollman GB. Measurement of experimental pain in chronic pain patients: methodological and individual factors. In: Mezack R (ed) Pain Measurement and Assessment. New York: Raven Press, 1983; 251-258.

[40] Keefe FJ, Bradley LA, Crisson J. Behavioural assessment of low back pain: identification of pain behaviour subgroups. *Pain* 1990, 40: 153-160.

Table 1. Subjects' sociodemographic and medical factors

		n* or mean ± standard deviation (range)
age (years)		82.3 ± 8.4 (54 – 97)
gender	male	17
	female	65
height (cm)		145.0 ± 6.7 (130.0 - 171.0)
weight (kg)		46.3 ± 8.4 (34.0 - 74.0)
duration of pain (months)		70.7 ± 110.1 (6.0 - 720.0)
site of pain	upper limb	15
	trunk	36
	lower limb	27
	other	4
history of surgery	yes	20
	no	62
use of walking aids	yes	60
	no	22
pain	NRS1	2.9 ± 1.6 (1 – 7)
	NRS2	2.9 ± 1.7 (1 – 8)
ADL	FIM	95.3 ± 12.7 (74 – 121)
PPT Battery	PPT1 (sec)	34.6 ± 18.1 (15.6 - 89.5)
	PPT2 (cm)	15.7 ± 6.4 (4.5 - 31.0)
	PPT3 (sec)	13.8 ± 7.2 (5.1 - 42.3)
	PPT4 (sec)	11.3 ± 6.7 (3.2 - 40.8)
	PPT5 (sec)	13.0 ± 7.2 (4.1 - 50.4)
	PPT6 (sec)	11.1 ± 5.8 (4.1 - 40.2)
	PPT7 (m)	159.3 ± 66.6 (55.0 - 301.5)
	PPT8 (sec)	9.7 ± 5.8 (4.0 - 40.6)

*: number of subjects

Table 2. Results of each test in the Japanese-language version of the PPT Battery for each rater

	rater 1		rater 2		rater 1 (re-test)	
	mean	SD*	mean	SD*	mean	SD*
PPT1 (sec)	34.65	18.14	34.82	18.21	35.13	17.92
PPT2 (cm)	15.76	6.41	15.73	6.42	15.89	6.28
PPT3 (sec)	13.87	7.21	14.03	7.28	13.89	6.93
PPT4 (sec)	11.32	6.77	11.40	6.72	11.08	5.08
PPT5 (sec)	13.07	7.28	13.10	7.33	12.82	5.77
PPT6 (sec)	11.14	5.80	11.23	5.79	10.70	4.85
PPT7 (m)	159.30	66.66	159.37	66.67	156.79	63.32
PPT8 (sec)	9.70	5.80	9.83	5.70	9.67	5.22

Table 3. Reliability of the Japanese-language version of the PPT Battery

intraclass correlation coefficient	PPT1	PPT2	PPT3	PPT4	PPT5	PPT6	PPT7	PPT8
inter-rater reliability	0.999	0.999	0.998	0.998	0.998	0.998	1.000	0.997
intra-rater reliability	0.993	0.984	0.973	0.919	0.943	0.954	0.979	0.960

Table 4. Relationship between the PPT Battery and the FIM

	PPT1	PPT2	PPT3	PPT4	PPT5	PPT6	PPT7	PPT8
r	−0.651	0.605	−0.569	−0.533	−0.467	−0.516	0.652	−0.555
p value*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

*: Spearman’s rank correlation coefficient

Table 5. Relationship between the PPT Battery and other factors －univariate analysis－

	PPT1		PPT2		PPT3		PPT4		PPT5		PPT6		PPT7		PPT8	
	r	p[a]	r	p	r	p	r	p	r	p	r	p	r	p	r	p
NRS1	0.26	*0.01*	－0.34	*<0.01*	0.18	0.08	0.16	0.15	0.25	*0.02*	0.11	0.31	－0.26	*0.01*	0.12	0.25
NRS2	0.30	*<0.01*	－0.44	*<0.01*	0.21	0.05	0.12	0.25	0.33	*<0.01*	0.19	0.07	－0.29	*<0.01*	0.21	*0.04*
age	0.23	*0.03*	－0.14	0.20	0.31	*<0.01*	0.12	0.26	0.16	0.15	0.22	*0.04*	－0.27	*0.01*	0.93	0.40
height	－0.14	0.21	0.21	0.05	－0.04	0.67	－0.19	0.08	0.01	0.87	－0.18	0.10	0.13	0.24	－0.10	0.37
weight	－0.04	0.66	0.17	0.12	－0.12	0.25	－0.06	0.59	0.22	0.84	－0.17	0.11	－0.04	0.70	0.33	0.77
duration of pain	0.02	0.82	0.04	0.70	0.07	0.51	0.08	0.44	0.13	0.22	0.01	0.97	0.07	0.51	－0.03	0.78

		PPT1		PPT2		PPT3		PPT4		PPT5		PPT6		PPT7		PPT8	
	n	mean rank	p[b]	mean rank	p	mean rank	p	mean rank	p	mean rank	p	mean rank	p	mean rank	p	mean rank	p
gender																	
male	17	52.65	*0.03*	40.06	0.77	44.00	0.67	46.65	0.31	40.91	0.90	38.65	0.57	32.03	0.65	50.03	0.09
female	65	38.58		41.88		40.85		40.15		41.65		42.25		43.98		39.27	
surgery																	
yes	20	42.03	0.91	42.98	0.75	43.93	0.60	39.90	0.73	45.03	0.44	41.68	0.97	42.93	0.75	39.95	0.73
no	62	41.33		41.02		40.72		42.02		40.36		41.44		41.04		42.00	

walk aids																
yes	60	46.50	*<0.01*	39.98	0.33	43.98	0.12	46.20	*<0.01*	44.08	0.10	43.52	0.20	35.67	*<0.01*	43.85	0.14
no	22	27.86		45.66		34.75		28.68		34.48		36.00		57.39		35.09	

a: Spearman’s rank correlation coefficient, b: Mann-Whitney *U*-test