J Rehabil Med 2007; 39: 358–362

ORIGINAL REPORT

A COMPARISON OF FOUR DISABILITY SCALES FOR TURKISH PATIENTS WITH NECK PAIN

Gulsah Kose, MD[1], Simin Hepguler, MD[1], Funda Atamaz, MD[1], and Gonca Oder, MD[2]

From the [1]Department of Physical Therapy and Rehabilitation and [2]Department of Rheumatology, Medical Faculty of Ege University, Bornova-Izmir, Turkey

Objective: **The Neck Disability Index, the Northwick Park Pain Questionnaire, the Copenhagen Neck Functional Disability Scale and the Neck Pain and Disability Scale are widely used scales for assessing neck pain or disability. The aim of this study was to determine the most suitable scale for Turkish patients with neck pain.**

Methods: **All scales were translated into Turkish, administered to 102 patients with neck pain, then compared with regard to their construct validity, reliability, responsiveness, acceptability and usefulness.**

Results: **The scales were similar in their high validity, reliability standards and sensitivity to change, but differed in their acceptability and usefulness. The item about driving in the Neck Disability Index and the Northwick Park Pain Questionnaire was omitted by 69.6% of patients for reasons other than a neck problem.**

Conclusion: **All scales were reliable, valid and sensitive instruments, with similar psychometric properties. The scale that most adequately reflects the patient should be chosen.**

Key words: neck pain, neck pain and disability scales, psychometric properties, Turkish translation.

J Rehabil Med 2007; 39: 358–362

Correspondence address: Funda Atamaz, Ege Universitesi Tıp Fakultesi, Fiziksel Tıp ve Rehabilitasyon Anabilim Dalı, Bornova-Izmir, Turkey. E-mail: atamaz_02@yahoo.com

Submitted May 5, 2006; accepted December 28, 2006

INTRODUCTION

Neck pain is among the most common chronic pain problems, with a reported prevalence of 22–30% (1–3). The mechanism of disability caused by neck pain has not yet been elucidated, but it is usually accompanied by a substantial effect on daily life that results in extensive use of healthcare resources (3, 4). To improve patients' functional status and quality of life, measuring neck pain is an important component of clinical practice, and requires validated instruments in order to gather information about the impact of disease, which is not offered by clinical and laboratory data. Although some authors have proposed generic instruments reflecting the various aspects of health status, it is generally recommended that region-specific instruments that can focus on the construct of neck pain or disability are more suitable due to their greater responsiveness and better content validity (5, 6).

In recent decades, several questionnaires have been designed and developed for this purpose: the Neck Disability Index (NDI), the Northwick Park Pain Questionnaire (NPQ), the Copenhagen Neck Functional Disability Scale (CDS) and the Neck Pain and Disability Scale (NPDS). These instruments have proved to be reliable, valid questionnaires and are widely used in English-speaking countries (7–10). The Turkish translation of the NPDS has also been shown to be valid and reliable (11). However, it is important to choose the most appropriate scale for a population, matching their needs. Even though some of these have until now been reported as the scales with the best psychometric properties, this may vary among populations with different socio-cultural status (12, 13). For example, NPDS has the best construct validity in French-speaking population (14), while NDI has been revalidated more often in English-speaking populations (6, 7, 13, 15).

The aim of this study was to assess the validity, reliability and responsiveness to clinical changes of these scales. The 4 scales were applied to the same patient population and compared with regard to their psychometric properties and usefulness, in order to determine the best instrument for use with Turkish patients with neck pain.

MATERIAL AND METHODS

Patients and study design

A total of 102 outpatients, age range 18–55 years, with neck pain of at least 6 weeks duration were included in the study. Neck pain was defined as non-specific neck pain without specific, identifiable aetiology (e.g. infection, inflammatory disease), but which could be reproduced by neck movement or provocation tests in the dorsal part of the neck in an area limited by a horizontal line through the most inferior portion of the occipital region and a horizontal line through the spinous process of the first thoracic vertebra (2). Patients with inflammatory arthritis were excluded. Patients were also excluded if they had a history of cervical spine injury or surgery, if their neck pain was secondary to other conditions (including neoplasm, neurological diseases or vascular diseases), if they had radiculopathy presenting neurological deficit, or if they had infection in the cervical spine. These exclusion criteria were verified by history, physical examination and X-ray. An additional exclusion factor was a history of mental illness.

All patients completed the Turkish version of scales twice within a 1–3 day interval without any therapy to assess test-retest reliability. The validation studies were based on the initial administration of the scales. In order to assess the responsiveness to clinical changes, the first 50 patients were randomized in 1:1 ratio to receive either non-steroidal anti-inflammatory drugs (NSAID) (naproxen sodium 500 mg/day, $n = 25$) or physical therapy (5 times a week for 3 weeks with a series of transcutaneous electrical nerve stimulation (TENS), ultrasound and infrared, $n = 25$), and then were re-administered the scales 7–10 days after the last treatment.

 ISSN 1650-1977
DOI: 10.2340/16501977-0060

Simultaneously, at all administrations of scales, the following clinical parameters were used to assess neck pain and disability by the same therapist:

- A pain-100 mm visual analogue scale (VAS) and a disability-VAS (the patients used the VAS to make a self-assessment of their pain and disability, with 0 representing no pain or disability, and 100 mm representing severe pain or disability).
- The physician's global assessment (the physician's judgement of the patient's general condition was measured on a VAS, with 0 representing good health including pain and disability, and 100 mm representing bad health).
- Muscle spasm (presence of spasm at the trapezius and paravertebral muscle, at the cervico-occipital region and at the lower cervical spine, was scored, with 0 representing no spasm, 1 representing spasm and the highest score being 6).
- Neck sensitivity (at the cervico-occipital junction, trapezius and "upper", "middle" and "lower" cervical spine, pain during palpation was scored with 0 presenting no pain, 1 presenting pain during deep palpation and 2 presenting pain during light palpation and the highest score being 20).
- Active range of motion (ROM) of the cervical spine in 3 planes with a universal goniometry as a reliable method when the same therapist takes the measurements (16).
- Pain with cervical motions (each of 7 motions was evaluated for pain, with score 0 presenting no pain, score 1 presenting slight pain, score 2 presenting severe pain on motion and the highest score would be 14).

In addition, baseline socio-cultural characteristics (including age, sex, education level, disease duration (months) and morning stiffness (minutes)) were recorded. For the education level, the patients were divided into 4 groups:

- Illiterate: no schooling, no reading or writing, or not completed elementary school.
- Low: completion of elementary school (at least 5 years schooling).
- Mid: completion of high school (at least 11 years schooling).
- High: graduation from university (at least 15 years schooling).

All the patients gave their informed consent for the study.

Study instruments

The NDI (7) is a 10-item scale. Each item assesses different neck pain complaints. It is a one-dimensional scale based on the Oswestry Index (17), which is designed for low back pain. Most of the items related to restrictions in activities of daily living, such as driving and reading, except one item measuring pain intensity. Each item is expressed by 6 different assertions in the range 0–5, with 0 indicating no disability and 5 indicating highest disability. The total score ranges from 0 to 50.

The NPQ (8) is a scale, which includes nine 5-part items to measure neck pain intensity and the consequent patient disability in activities of daily living, such as how the neck pain interferes with the patient's driving. Like the NDI, it is based on the Oswestry Index (17). The scoring has a similar format with NDI, with 0 indicating no disability and 4 indicating highest disability. The total score ranges from 0 to 36.

The CDS (9) is a 15-item scale. The items are questions to assess disability in activities of daily living experienced by patients with neck pain, for which the responses are "yes", "no" and "occasionally". The total score ranges from 0 to 30, the higher score indicating the greater disability.

The NPDS (10) is a multidimensional and self-administered scale, which contains 20 items related with 4 dimensions: neck problems, pain intensity, emotion-cognition and interference with life activities. Each item is ranging from 0 (normal function) to 5 (the worst possible situation your pain problem has taken you) by using a VAS, which was divided into 6 sections with equal intervals. The total score ranges from 0 to 100.

All the scales were translated into Turkish in 3 steps by the forward and backward translation procedure. First, 3 Turkish bilingual volunteers who were fluent in English translated the original questionnaire. They then met as a group to review the translations and make cultural and vocabulary adaptations. In the second step, 3 independent bilingual volunteers back-translated the reviewed version of the questionnaire into English. Finally, language discrepancies between backward and original scales were discussed by all translators, 15 individuals with good health completed the Turkish versions of the scales to make final adaptation as a pilot testing in the third step.

Statistical analyses

All the scales were given as a quantitative data. Before statistical analyses, all answers were checked and evaluated by item-concerning, missing responses and multiple responses.

The reliability studies were performed by internal consistency and test-retest reliability. Internal consistency expressed by the coefficient alpha (α) or Cronbach's coefficient (18) was used for each subscale, and if the Cronbach's coefficient value was greater than 0.7, it was considered as an acceptable internal consistency (19). Reproducibility was evaluated using the intraclass correlation coefficient (ICC) (20).

The validation studies were assessed by construct validity, which refers to the scale's behaviour in relation to other related assessment tools. For construct validity, the correlation studies were used between scales and the clinical measures described above which could be expected to have a converging relationship.

Responsiveness was evaluated by standardized response mean (SRM) (21). The SRM is the mean change in score divided by the standard deviation of the changes in scores. A larger SRM indicates a greater sensitivity to change. The Wilcoxon test was performed separately for each treatment group to test for changes over time. For the group comparisons with regard to changes over time on the scales and clinical measures, the Mann-Whitney *U* test was used. To assess the clinical relevance of the changes, correlation analyses were used between clinical measures and scales. For definition of the effects of education and age on the scales, correlation analyses were also performed between scales and these demographic variables. The correlation analyses were performed by using Pearson's rank correlation coefficients. If a normal distribution could not be shown for the parameters studied, Spearman's coefficient values were used.

SPSS for Windows software was used for data management and statistical analysis. All the results were expressed as mean ± SE (standard error of the mean).

Table I. *Neck pain patients' demographic and clinical characteristics.*

Characteristic	Mean (SD)
Age (years)	45.3 (9.25)
Gender (%)	
Female	83 (81.4%)
Male	19 (18.6%)
Education level (%)	
Illiterate	2 (2.0%)
Low	21 (20.6%)
Mid	40 (39.2%)
High	39 (38.2%)
Morning stiffness (minutes)	21.3 (21.5)
Pain duration (months)	32.1 (34.1)
VAS – pain (mm)	44.1 (23.8)
VAS – disability (mm)	53.2 (19.9)
VAS – physician's assessment (mm)	39.8 (19.9)
Muscle spasm (0–6)	3.4 (0.7)
Neck sensitivity (0–20)	3.3 (1.7)
Range of motion (degree)	
Flexion and extension*	120.1 (8.7)
Lateral flexion†	80.0 (5.2)
Rotation†	136.2 (10.3)
Pain with motion (0–14)	5.6 (1.9)

*Flexion and extension summed. †Left and right sides summed.
SD: standard deviation; VAS: visual analogue scale.

RESULTS

Table I shows the demographic and clinical characteristics of the patients. The mean age was 45.3 years (SD 9.2) (age range 20–55 years). Eighty-three of the patients were female (81.4%) and 19 were male (18.6%). Mean disease duration was 32.1 (SD 34.1) (2–120) months. Most of the patients had middle (39.2%) or high education level (38.2%).

The scales were completed by all the patients. Only 2 illiterate patients needed assistance to complete the scales. The omitted answer rates were 7.7%, 8.0%, 0.9% and 0.8% for NDI, NPQ, CDS, NPDS, respectively. There was no comprehension problem with the questions. However, for the NDI and NPQ scales, the missing data rates were relatively high in our study population in which the questions on driving were not answered by 69.6% of patients who were not driving even in good health. Therefore, these items were excluded from the statistical analyses. There were few multiple answers in all scales (1.3%, 1.3%, 0.3% and 0.7% for NDI, NPQ, CDS and NPDS, respectively). The mean time needed for completing of scales were 8.8 (SD 3.4), 8.4 (SD 3.9), 6.8 (SD 2.7) and 10.2 (SD 4.8) minutes for NDI, NPQ, CDS and NPDS, respectively.

Results of reliability analyses and the mean scores of scales are presented in Table II. Test-retest reliability was good for all scales with higher ICC values than 0.80 (0.86, 0.85, 0.84 and 0.81 for NDI, NPQ, CDS and NPDS, respectively). Cronbach's α was variable from moderate to high in all 4 scales with coefficients ranging 0.80 (for NPQ and CDS) to 0.94 (for NPDS).

Table III shows the results of validity analysis. Correlation analyses revealed statistically significant moderate-to-high correlations between the scales and all clinical measures ($p < 0.001$). The strength of the correlations was similar for all the scales. All the scales were moderate-highly related to VAS-pain and disability scores (between 0.59 and 0.81), although the weaker correlations were observed with VAS-physician's assessment (between 0.35 and 0.50). Similarly, there were also significant correlations between scales and muscle spasm, neck sensitivity, pain with motion scores and morning stiffness (between 0.29 and 0.58). All the scales were negatively correlated with ROM of the cervical spine (between –0.33 and –0.43). When correlation analyses were performed between the scales and demographic variables, no substantial correlations (above $r = 0.21$) were found with age and educational level (Table III). In addition, none of the scales were substantially related to disease duration.

Table II. *Internal consistency and test-retest reliability of the scales.*

	Visit 1 (n = 102) Mean (SD)	Visit 2 (n = 102) Mean (SD)	ICC*	Cronbach's α†
NDI	32.1 (6.6)	14.1 (6.7)	0.86	0.90
NPQ	12.1 (4.7)	11.9 (4.8)	0.85	0.80
CDS	12.5 (6.3)	12.8 (6.4)	0.84	0.80
NPDS	39.1 (19.8)	37.0 (20.6)	0.81	0.94

*Intraclass correlation coefficient (ICC) between scores of visit 1 and visit 2.
†Internal consistency.
NDI: Neck Disability Index; NPQ: Northwick Park Pain Questionnaire; CDS: Copenhagen Neck Functional Disability Scale; NPDS: Neck Pain and Disability Scale; SD: standard deviation.

Table III. *Correlation analyses between the scales and other clinical and demographic measures in neck pain patients.*

	NDI	NPQ	CDS	NPDS
Age	–0.06	–0.07	–0.04	–0.13
Education level	–0.11	–0.15	–0.09	–0.06
Disease duration	0.13	0.17	0.14	0.18
Morning stiffness	0.36*	0.41*	0.38*	0.40*
VAS-pain	0.65*	0.73*	0.59*	0.73*
VAS-disability	0.71*	0.81*	0.63*	0.69*
VAS-physician's assessment	0.39*	0.50*	0.35*	0.46*
Muscle spasm	0.37*	0.36*	0.31*	0.29*
Neck sensitivity	0.58*	0.53*	0.47*	0.47*
Flexion and extension†	–0.41*	–0.43*	–0.38*	–0.35*
Lateral flexion‡	–0.36*	–0.37*	–0.34*	–0.33*
Rotation‡	–0.41*	–0.41*	–0.39*	–0.39*
Pain with motion	0.50*	0.49*	0.44*	0.49*

†Flexion and extension summed. ‡Left and right sides summed.
†$p < 0.05$, *$p < 0.01$.
NDI: Neck Disability Index; NPQ: Northwick Park Pain Questionnaire; CDS: Copenhagen Neck Functional Disability Scale; NPDS: Neck Pain and Disability Scale; VAS: visual analogue scale.

Table IV represents the results of the responsiveness. Of the 50 patients who received treatment, 48 assessed at the follow-up. At the end of the study, the scores of all the scales and the other clinical measures had improved markedly ($p < 0.01$). Comparison analyses revealed no differences between treatment groups in the improvement for all measures. All the scales showed good sensitivity to change with nearly identical SRM values. After the treatments, correlation analyses revealed that all the scales were strongly related to all clinical measures (Table V). In other words, a decrease in the test scores corresponded with an improvement in the clinical measures ($p < 0.01$).

DISCUSSION

The translated scales can serve as an important complementary tool for a more reliable assessment of patients suffering from neck pain. For the evaluation and selection of an appropriate

Table IV. *Responsiveness of the scales in both treatment groups who had neck pain.*

	Physical therapy group (n = 24)			NSAID group (n = 24)		
	Mean difference	SRM	p	Mean difference	SRM	p
NDI	5.5	0.85	0.002	5.3	0.86	0.003
NPQ	5.1	0.93	0.001	5.3	0.91	0.001
CDS	5.8	0.89	0.003	5.5	0.87	0.002
NPDS	20.5	0.92	0.0001	18.4	0.89	0.001

NSAID: non-steroidal anti-inflammatory drugs; NDI: Neck Disability Index; NPQ: Northwick Park Pain Questionnaire; CDS: Copenhagen Neck Functional Disability Scale; NPDS: Neck Pain and Disability Scale; SRM: standardized response mean.

Table V. *Correlation analyses between the scales and other clinical measures after the treatments.*

	NDI	NPQ	CDS	NPDS
Morning stiffness	0.60**	0.58**	0.55**	0.61**
VAS-pain	0.81**	0.78**	0.72**	0.83**
VAS-disability	0.73**	0.61**	0.82**	0.82**
VAS-physician's assessment	0.79**	0.81**	0.65**	0.79**
Muscle spasm	–0.55**	–0.46**	–0.58**	–0.34**
Neck sensitivity	–0.29**	–0.15	–0.29**	–0.38**
Flexion and extension	–0.29*	–0.29*	–0.30*	–0,28*
Lateral flexion	–0.71**	–0.72**	–0.53**	–0.70**
Rotation	–0.48**	–0.45**	–0,35*	–0,46**
Pain with motion	–0.63**	–0.62**	–0.59**	–0.62**

*$p < 0.05$, **$p < 0.01$.
NDI: Neck Disability Index; NPQ: Northwick Park Pain Questionnaire; CDS: Copenhagen Neck Functional Disability Scale; NPDS: Neck Pain and Disability Scale; VAS: visual analogue scale.

scale, several properties of the scale, such as the acceptability, user friendliness, high reliability, validity and responsiveness to clinical changes may function as a guide. The results of the present study showed that the translated versions of the NDI, the NPQ, the CDS and the NPDS scales have acceptable reliability, validity and responsiveness for Turkish-speaking patients with neck pain.

The results of reliability analysis in term of internal consistency were satisfactory because Cronbach's coefficient value was greater than 0.7 for each scale as recommended (14, 18). The somewhat higher coefficient values of NPDS may be due to the larger numbers of items in this scale. In addition, test-retest reliability results were similar within the scales, indicating that the scales have high reliability.

In this present study, for all scales, we assessed the construct validity by analysing the relationship between scale scores and clinical measures. The results of the correlation analysis showed that construct validity was highly satisfactory and was nearly identical for all scales. The strong correlations of scales with respect to VAS-pain and VAS-disability scores were similar to previous data (9–11, 15, 21). There were also high correlations between the physician's judgment on a VAS and scale scores (9, 10). As expected, the same strong correlations were also seen between the scale scores and the examination findings, such as ROM and neck sensitivity, in accordance with previous studies (21).

Responsiveness is nearly as important as validity and reliability for the assessment of scales. In our study, longitudinal data of 48 patients who received treatment showed significant improvement on both the scale scores and clinical measures after 4 weeks. This result support that both treatment regimens are effective in the neck pain, as previously reported (22–24). Sensitivity to change between entry and evaluation at week 4 was demonstrated in all scales, and the SRM values were nearly identical. The correlation analyses supported that all the scales were sensitive to changes. Moreover, this is the first study in which the sensitivity to change of the CDS has been studied, although the good sensitivity of the other scales to change has been reported previously (25).

Finally, our results suggest that all the scales are similar in their high reliability, validity and responsiveness. Lack of significant difference concerning their psychometric properties between the scales was probably due to their primary focus on same health aspects. In order to make a decision regarding an appropriate scale, the most important point is to measure the scale's psychometric properties. However, after this point is clarified, the applicability and user friendliness of the scales should be considered as additional selection criteria. In our study, only 2 illiterate patients needed assistance to complete the scales. This indicated that all the scales could be successfully self-administered by patients with neck pain. Although there was no major comprehension problem with the scales, for the NDI and the NPQ scales, the item about driving was not answered in approximately 70% of cases, for reasons other than a neck problem. Indeed, this missing data associated with driving has been reported previously and handled by either excluding the questionnaires that contained missing data or calculating the mean score of all completed items (6, 15). It should be noted, however, that our rate of missing data was considerably higher than that of these studies. Besides the fact that the Turkish population prefers public transport, this missing data rate is also higher than presumed by the investigators in the first stage of this project. This may be because there is a lower driving rate among Turkish women than men for socio-cultural reasons. Considering the socio-cultural structure of the Turkish population, these items could be eliminated from the final versions of the scales after pilot testing, but the determination of this was made difficult due to a lack of sufficient statistical data about driving in Turkey and an absence of a standardized approach regarding management of missing fields in the literature. We therefore attempted to apply the scales without elimination of any item and gave the information to patients about this field before administration of the scales. On the other hand, we believe that the acceptability and usefulness of these items will increase in the future due to increasing interest in driving among young people in Turkey. As for the CDS and NPDS, the acceptability of these scales was good, as shown by the low number of missing and multiple responses. However, in clinical practice, the CDS may be preferred because it takes less time to complete.

We examined the possible influences of the demographic variables on the scales at the same time because it is important to understand the factors that contribute to pain sensitivity and disability. Although demographic values, such as ageing and education, have been associated with neck pain and disability (26, 27), none of these had any effect in our study. However, in our study, the mean age of patients was considerably lower than that of other population studies, as there were no patients older than 55 years. In addition, the education level was modest or high in a majority of our patients. Considering these demographic characteristics of our population, the absence of correlation between the scale scores and demographic variables may be explained.

In summary, all the scales were sensitive to change and similar in their high validity, reliability standards in the patients

with neck pain. They are potentially useful measures to help patients and clinicians, and they meet the needs and criteria of a scale to understand the influence of neck pain on daily life. On the other hand, since the NDI and the NPQ scales had considerably high rates of missing data due to the item about driving, the clinician or researcher should consider the type of patient population to be targeted as well as the psychometric properties of the scale and choose the scale that best reflects the patient.

ACKNOWLEDGEMENT

We thank the volunteers who helped with translation of the questionnaire.

REFERENCES

1. Andersson HI, Ejlertsson G, Leden I, Rosenberg C. Characteristics of subjects with chronic pain, in relation to local and widespread pain report. A prospective study of symptoms, clinical findings and blood tests in subgroups of a geographically defined population. Scand J Rheumatol 1996; 25: 146–154.
2. Bovim G, Schrader H, Sand T. Neck pain in the general population. Spine 1994; 19: 1307–1309.
3. Wolsko PM, Eisenberg DM, Davis RB, Kessler R, Phillips RS. Patterns and perceptions of care for treatment of back and neck pain: results of a national survey. Spine 2003; 28: 292–297.
4. Boden SD, Swanson AL. An assessment of the early management of spine problems and appropriateness of diagnostic imaging utilization. Phys Med Rehabil Clin N Am 1998; 9: 411–417.
5. Patrick DL, Deyo RA. Generic and disease-specific measures in assessing health status and quality of life. Med Care 1989; 27 Suppl 3: S217–322.
6. Riddle DL, Stratford PW. Use of generic versus region-specific functional status measures on patients with cervical spine disorders. Phys Ther 1998; 78: 951–963.
7. Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity. J Manipulative Physiol Ther 1991; 14: 409–415.
8. Leak AM, Cooper J, Dyer S, Williams KA, Turner-Stokes L, Frank AO. The Northwick Park Neck Pain Questionnaire, devised to measure neck pain and disability. Br J Rheumatol 1994; 33: 469–474
9. Jordan A, Manniche C, Mosdal C, Hindsberger C. The Copenhagen Neck Functional Disability Scale: a study of reliability and validity. J Manipulative Physiol Ther 1998; 21: 520–527.
10. Wheeler AH, Goolkasian P, Baird AC, Darden BV 2nd. Development of the Neck Pain and Disability Scale. Item analysis, face, and criterion-related validity. Spine 1999; 24: 1290–1294.
11. Bicer A, Yazici A, Camdeviren H, Erdogan C. Assessment of pain and disability in patients with chronic neck pain: reliability and construct validity of the Turkish version of the neck pain and disability scale. Disabil Rehabil 2004; 26: 959–962.
12. DeVellis RF. A consumer's guide to finding, evaluating, and reporting on measurement instruments. Arthritis Care Res 1996; 9: 239–245.
13. Pietrobon R, Coeytaux RR, Carey TS, Richardson WJ, DeVellis RF. Standard scales for measurement of functional outcome for cervical pain or dysfunction: a systematic review. Spine 2002; 27: 515–522.
14. Wlodyka-Demaille S, Poiraudeau S, Catanzariti J-F, Rannou F, Fermanian J, Revel M.. French Translation and Validity of 3 Functional Disability Scales for Neck Pain. Arch Phys Med Rehabil 2002; 83; 376–382.
15. Hains F, Waalen J, Mior S. Psychometric properties of the neck disability index. J Manipulative Physiol Ther 1998; 21: 75–80.
16. Youdas JW, Carey JR, Garrett TR. Reliability of measurements of cervical spine range of motion – comparison of three methods. Phys Ther 1991; 71: 98–104.
17. Fairbank JC, Couper J, Davies JB, O'Brien JP. The Oswesty Low Back Pain Disability Questionnaire. Physiotherapy 1990; 66; 271–273.
18. Cronbach LJ. Coefficient alpha and the internal structure of tests. Psychometrika 1951; 16; 297–334.
19. DeVellis RF, editor. Scale development: theory and applications. Newbury Park, CA: Sage, 1991.
20. Shout PE, Fleiss JL. Intraclass correlations: using in assessing rater reliability. Psychol Bull 1979; 86; 420–428.
21. Tuley MR, Mulrow CD, McMahan CA. Estimating and testing an index of responsiveness and the relationship of the index to power. J Clin Epidemiol 1991; 44: 417–421.
22. Day RO, Rowett D, Roughead EE. Towards the safer use of non-steroidal anti-inflammatory drugs. J Qual Clin Pract 1999; 19: 51–53.
23. Boskovic K. Physical therapy of subjective symptoms of the cervical syndrome. Med Pregl 1999; 52: 495–500.
24. Wang WT, Olson SL, Campbell AH, Hanten WP, Gleeson PB. Effectiveness of physical therapy for patients with neck pain: an individualized approach using a clinical decision-making algorithm. Am J Phys Med Rehabil 2003; 82: 203–218.
25. Wlodyka-Demaille S, Poiraudeau S, Catanzariti JF, Rannou F, Fermanian J, Revel M. The ability to change of three questionnaires for neck pain. Joint Bone Spine 2004; 71: 317–326.
26. Croft PR, Lewis M, Papageorgiou AC, Thomas E, Jayson MI, Macfarlane GJ, Silman AJ. Risk factors for neck pain: a longitudinal study in the general population. Pain 2001; 93: 317–325.
27. Webb R, Brammah T, Lunt M, Urwin M, Allison T, Symmons D. Prevalence and predictors of intense, chronic, and disabling neck and back pain in the UK general population. Spine 2003; 28: 1195–1202.