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The Cultural Adaptation, Reliability, and Validity of Neck Disability Index in Patients With Neck Pain

A Turkish Version Study

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Study Design. The cultural adaptation of Neck Disability Index (NDI), the validity and reliability of Turkish version.

Objective. The aim of this study was to conduct a study concerning the cultural adaptation of NDI and investigate the validity and reliability of its Turkish version in patients with neck pain.

Summary of Background Data. The NDI is a reliable evaluation instrument for disability but there is no published Turkish version.

Methods. Eighty-eight patients with neck pain for at least 3 months were included in the study. NDI, The Neck Pain and Disability Scale, and Visual Analogue Scale (VAS) were completed by all subjects. Test-retest reliability was determined by using intraclass correlation coefficient and Pearson correlation analysis. For the determination of concurrent validity, the relation between NDI and VAS was examined by Pearson correlation analysis and for the determination of construct validity, the relation between NDI and Neck Pain and Disability Scale was investigated.

Results. Intraclass correlation coefficient score for test-retest reliability was 0.979 (95% confidence interval = 0.968–0.986). For concurrent validity, the relation between NDI and VAS was investigated, the *r* value for test and retest was 0.508 and 0.620, respectively ($P < 0.0001$). For construct validity, the relation between NDI and the Turkish version of Neck Pain and Disability Scale was investigated, the r value for test and retest was 0.659 ($P < 0.0001$) and 0.728 ($P < 0.0001$), respectively.

Conclusion. The results suggest that the Turkish version of the NDI validated in this study is an easy to understand, reliable, and valid instrument for the measurement of the limitation of activities of daily living and pain caused by neck disorders in the Turkish-speaking population.

Key words: neck pain, Neck Disability Index. **Spine 2009;34:1732–1735**

Neck pain is one of the major complaints among the cervical spine disorders and is also a common complaint in most communities. It is almost as common as back problems and annually about 30% of the population experiences neck pain. Of this group 14% report complaints lasting longer than 6 months. The exact cause of most mechanical neck pain remains elusive; however, the prevalence rises with age and is higher in women than in men.[1,2]

Considering the cost of neck pain complaints to society, it is surprising that there were insufficient numbers of methods evaluating patients with soft-tissue injuries of the cervical spine, especially those assessing the level of disability, related with activities of daily living. However, the injuries to the cervical spine, importantly those involving soft tissues; represent a significant source of chronic disability. Thus, quantification of pain is necessary not only for the evaluation of current and future therapies but also for assessing outcome measures of impairment and disability.[1,3]

Valid and reliable tests are cornerstones in clinical research. Although measuring health status is an important component of clinical practice reflecting the degree of disability, region-specific functional questionnaires measuring everyday activity limitations due to chronic neck pain are highly recommended. The Pain Disability Index and the Impact Profile are accepted functional instruments measuring generalized pain but they are not specifically designed for patients with neck pain. On the other hand, region-specific functional outcome questionnaires concentrate on specific areas of the body and may possibly measure dysfunction with greater responsiveness than a scale assessing overall parameters.[1,4,5]

The Neck Disability Index (NDI) was designed by Vernon and Mion to assess how neck pain affects the activities of daily living. In a 3-year prospective study that was conducted for the prediction of long-term health problems after whiplash injury, only NDI was significantly correlated with the actual outcome. Also, in cross-cultural studies that were conducted in French, Swedish (though modified), Portuguese, and Dutch, the NDI was proved to be a valid and reliable instrument to measure disability.[2,5]

Since there are a few number of scales evaluating pain in neck problems, disability outcome measures are needed specifically for non-English speaking patients. Instead of developing a new scale and leading to multiplication of outcome measures lacking comparison of populations, we preferred to adjust and adopt an existing instrument, the NDI. In our opinion, this would help the exchange of information across cultural and linguistic barriers with carefully tested psychometric properties of the translated versions.[5,6]

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The aim of this study was to conduct the Turkish validation and cross-cultural adaptation study of NDI on Turkish patients with neck pain.

■ Materials and Methods

Participants

Eighty-eight outpatients who were referred to Hacettepe University School of Physical Therapy and Rehabilitation with neck pain for at least 3 months were included in the study (65 women, 23 men). The patients with serious diseases causing disability, regional tumors or metastasis, vertebral fractures and disc herniation that requires surgical treatment, psychiatric disorders, traumatic injuries, neck surgery, pregnancy, and the ones who could not read and speak in Turkish were excluded from the study.

Scales

NDI. NDI was designed by Vernon and Mior[3] was modified from Oswestry Disability Questionnaire.[7] The scale has 10 sections: pain intensity, personal care, lifting, reading, headaches, concentration, work, driving, sleeping, and recreation, each consisted of 6 questions. Item scores range from 0 (no disability) to 5 (total disability)

Neck Pain and Disability Scale (NPAD). The Turkish version of NPAD was conducted by Bicer *et al* in 2004.[1] The scale consists of 20 items that measure problems related to neck; intensity of pain, effect of pain on functions of daily living, and the presence and extent of associated emotional factors. Patients respond to each item by scoring on a 10-cm scale.

Translation

Permission for the translation of the NDI was taken *via* e-mail from Dr. Howard Vernon before the study. During the translation period crosscultural adaptation design proposed by Beaton *et al* was used.[8] Translation from English to Turkish was performed by 2 different bilingual translators whose mother language was Turkish. One of the translators was blind to the purpose of the study and the concepts being examined in the questionnaire. This was for providing equivalency from a clinical perspective rather than a literal equivalence. The other translator was informed about the purpose of the study and the concepts being quantified. This was for reflecting the language that is used by the population and highlighting ambiguous meanings in the original questionnaire. The 2 translations were compared with each other in order to eliminate any possible discordance. Both of the translations were then back translated into English by 2 native English speakers who were totally blind to the original version of the index and did not know the purpose of the study. The 2 back-translated English versions were then compared with the original version of the Neck Disability Index. A bilingual team consisted of 4 translators and 3 physiotherapists reviewed the Turkish version of the questionnaire to ensure crosscultural equivalence and form the prefinal version for field testing. The Turkish version of the index was then compared with the original one to achieve semantic, idiomatic, experimental, and conceptual equivalence.

The last stage of the process was to test the prefinal version. Thirty-one patients with neck pain completed the translated questionnaire to determine any misunderstandings and deviations in the translation. The acceptability and comprehensibility of the translation were tested item by item. The following modifications were done in the final adaptation;

In the second and third section, the expression of "extra pain" was replaced by "existent pain" (instead of "without extra pain," we used "without increase in my existent pain" I can look after myself).

In the third section most of the patients couldn't understand the expression of "heavy weights." They asked "How many kilograms?" Therefore, this expression was replaced by "the weights which are heavy for me."

The patients skipped the section 6, because they did not understand the expression of "concentration." Thus, this word's meaning was explained as paying attention.

In the seventh section, the expression of "work" was changed to "business life" because this word was misunderstood as activities of daily living, such as shopping or housework by the patients.

The 10th section was also skipped by the patients because the term recreation was unclear, so this word was replaced by "leisure activities."

After the pilot study, the new version was administrated to 88 patients who had neck pain by 3 physiotherapists. Seven days later, patients were asked to answer the same questionnaire for retest. Demographic characteristics and other related history were recorded for each patient. Level of disability was evaluated with NDI and Neck Pain and Disability Scale, whereas the level of pain was evaluated using Visual Analog Scale (0 no pain, 10 severe pain).

Reliability Measurements

Test-retest reliability: for test-retest reliability, the questionnaire was administered 2 times. The period between the 2 measurements was 7 days. Test-retest reliability was determined by using intraclass correlation coefficient (ICC) and Pearson correlation analysis. During this period, no medical treatment was given.

ICCs can vary from 0.00 to 1.00 where values of 0.60 to 0.80 are regarded as evidence of good reliability, with those above 0.80 indicating excellent reliability. Portney and Watkins claim that for most clinical measurements, reliability should exceed 0.90 to ensure reasonable validity.[9,10]

Validity

Concurrent validity: for criterion related validity, concurrent validity method was used. For this purpose, the relation between NDI and VAS was examined by Pearson correlation analysis.

Construct validity: the construct validity was examined by comparing NDI with NPDA. Construct validity coefficients were accepted as follows: $r \geq 0.81$ to 1.0 as excellent, 0.61 to 0.80 very good, 0.41 to 0.60 good, 0.21 to 0,40 fair, and 0 to 0.20 poor.[9] The relation was evaluated with Pearson correlation analysis.

■ Results

The mean age of the patients who participated in the study was 37.82 ± 12.08 years ranging from 17 to 72 years. The mean duration of pain was 228.03 ± 252.34 days. Table 1 shows the demographic and clinical characteristics of the patients. Table 2 shows diagnosis of the patients.

Test-Retest Reliability

ICC score for test-retest reliability was 0.979 (95% CI = 0.968–0.986). According to Pearson correlation analy-

Table 1. Demographic Characteristics of the Patients

	n	mean	SD
Age (yr)	88	37.82	12.08
Height (cm)	88	164.57	8.46
Weight (kg)	88	66.17	10.72
Duration of pain (wk)	88	228.03	252.34

Table 2. The Diagnosis of the Patients

Diagnosis	*n*	%
Cervical disc herniation	33	37.50
Cervical osteoarthritis	26	29.55
Mechanical disorders	16	18.18
Other (*e.g.,* traumatic conditions or the patients with no diagnosis but neck pain)	13	14.77

sis, *r* value was 0979 ($P < 0.0001$). There was no difference between test-retest scores ($P > 0.05$).

Concurrent Validity

When the relation between NDI and VAS was investigated, the r value for test and retest was 0.508 (good) and 0.620 (very good), respectively ($P < 0.0001$). These results showed that the concurrent validity of the Turkish version of NDI was good-very good.

Construct Validity

When the relation between NDI and NPDA was investigated, the *r* value for test and retest was 0.659 ($P < 0.0001$) and 0.728 ($P < 0.0001$), respectively. These results showed that the construct validity of the Turkish version of NDI was very good.

■ Discussion

This study showed that NDI is a valid and reliable method of measuring disability in Turkish patients with neck pain.

Test-retest reliability was found to be ICC = 0.979 at 1 week interval (ICC values above 0.80 were accepted as excellent reliability).[9] Vos *et al* conducted a study concerning the Dutch version of NDI and found the ICC as 0.979, which is same in our study.[2] Also Vernon and Mior who were among the developers of the questionnaire administered the NDI to patients having neck pain as a result of whiplash injury and in patients complaining of neck pain without trauma on a basis of 2 days intervals, and found the ICC as 0.89.[3] In addition, Wlodyka *et al* conducted a study on the validity and reliability of 3 functional scales evaluating neck pain and reported that ICC for NDI as 0.93.[6] All of these results are similar to our findings indicating a high adaptation of NDI into Turkish culture. In the analysis of concurrent validity, NDI-VAS correlation was found to be $r = 0.508$ (good) ($P < 0.0001$).

The results of our study showed that the construct validity of NDI is very good. The high correlation between 2 tests indicates that they are exchangeable in use. Although the amount of time necessary to complete NDI and NPAD was close in our study, the comprehensibility of NPAD was low compared to NDI. Patients were in contradiction while scoring NPAD consisting of complete vertical lines, semicomplete vertical lines, and the areas between the lines. The same problem was reported by Bicer *et al* who conducted a study concerning the Turkish version of NPAD.[1] Agarwal *et al* reported that the physical design of NPAD caused patients to contradictorily answer the questions, so the reliability of marking was sceptical. For that reason, the researchers rearranged NPAD as consisting of only the complete vertical lines.[11] Wlodyka *et al* declared that they did not understand how patients were going to mark the subdivided VAS. For that reason, the researchers changed the subdivided VAS as undivided VAS and adapted it as 0 to 2000 changing between 0 and 100.[6] In the light of these results, the comprehensibility of NDI was thought to be higher than NPAD. Nonetheless, Hoving *et al* acquainted that in patients having disorders related with whiplash injury, emotional and social problems are very often highlighting a limitation of the questionnaire which does not contain any element related to these problems.[12]

In our study, 21 patients (23.87%) did not answer the section 8 (driving). It is thought that the number of patients not answering this section was low, so no modifications were made. In the Turkish version of NPAD conducted by Bicer *et al*, only 19.1% of the patients had answered the question related to driving. However, the researchers did not feel a necessity to make any changes.[1] Also in another study conducted by Wlodyka *et al*, 5% of patients did not answer the section of driving in Northwick Park Neck Pain Questionnaire (NPQ). Researchers noted that they conducted the study in urban regions in which people do use community transport but the questionnaire was developed for the entire French citizen.[6] Similarly in Turkey, community transport is commonly preferred and also our study was conducted in urban region. Also, in the Dutch version, 21% of the patients did not answer this section.[2]

■ Conclusion

The results suggest that the Turkish version of the NDI validated in this study is an easy to understand, reliable, and valid instrument for the measurement of the limitation of activities of daily living and pain caused by neck disorders in the Turkish-speaking population.

■ Key Points

- NDI is a valid and reliable measurement tool for Turkish population.
- The questionnaire was applied at 1-week interval.
- The time needed to apply the questionnaire is found to be short in a clinical setting.

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