Reliability and cross-cultural adaptation of the Turkish version of the Spinal Cord Injury Spasticity Evaluation Tool

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The Spinal Cord Injury Spasticity Evaluation Tool is a 7-day recall self-reported questionnaire that assesses the problematic and useful effects of spasticity on daily life in patients with spinal cord injury (SCI). We aimed to determine the reliability and cross-cultural validation of the Turkish translation of the Spinal Cord Injury Spasticity Evaluation Tool (SCI-SET$_T$). After translation and back translation of the Spinal Cord Injury Spasticity Evaluation Tool, 66 patients between the ages of 18 and 88 years with SCI, American Spinal Injury Association impairment scale grades from A to D with spasticity, and at least 6 months after injury were assessed. Participants rated the SCI-SET$_T$ at the same time period of the day, 1 week apart, and test–retest agreement was investigated. Also, the Penn Spasm Frequency Scale, self-assessment of spasticity severity, self-assessment of spasticity impact, Functional Independence Measure motor subscale, and 36-Item Short Form Health Survey were assessed for the evaluation of the convergent validity. There were 45 participants with tetraplegia and 21 patients with paraplegia. The test–retest reliability for the SCI-SET$_T$ was good. The intraclass correlation coefficient was 0.80 at 95% confidence interval. There were no significant correlations between the SCI-SET$_T$ scores and Functional Independence Measure motor subscale and Penn Spasm Frequency Scale scores. There was a significant correlation between the SCI-SET$_T$ scores and vitality scores of the 36-Item Short Form Health Survey. The SCI-SET$_T$ showed statistically significant correlations with other measures including self-assessed spasticity severity and self-assessed spasticity impact ($P < 0.05$). The SCI-SET$_T$ is a reliable self-rating tool for assessing spasticity in patients with SCI in the Turkish population. *International Journal of Rehabilitation Research* **40:152–157**

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Introduction

Spasticity is a common sensorimotor symptom complex, considered a long-term complication in patients with spinal cord injury (SCI). The Ability Network, which is an international initiative organized to optimize the management of disabling spasticity following SCI, has proposed a consensus on the definitions of spasticity (Burns, 2016). The group recommends adoption of the definition by the SPASM group: 'disordered sensorimotor control, resulting from an upper motor neuron lesion, including positive features of upper motor neuron syndrome, presenting as intermittent or sustained involuntary activation of muscles' (Pandyan *et al.*, 2005). The Ability Network focuses on the motor control and the symptoms experienced by those living with spasticity. In addition, the group suggests that disabling spasticity be defined as 'spasticity which is perceived by the individual or caregivers as hindering body function, activities and/or participation'. This definition conceptually incorporates the domains of the International Classification of Function, Disability and Health (Burns, 2016).

The frequency of spasticity observed among patients with SCI varies in different studies from 65 to 78% (Balioussis *et al.*, 2014; Maynard *et al.*, 1990; Sköld *et al.*, 1999). Not everyone with spasticity experiences disabling spasticity. A decision to treat spasticity depends largely on whether or not it interferes with the patient's daily life. Although spasticity may be of some benefit in the maintenance of muscle tone, it can interfere with daily activities such as transfers, ambulation, and sleep.

Spasticity is a multidimensional phenomenon and its proper evaluation is difficult and challenging. A reliable assessment of spasticity is necessary to formulate convenient treatment plans. There are clinical scales such as the Ashworth Scale, the Tardieu Scale, and the Spinal Cord Assessment Tool for Spastic Reflexes that have been used to measure spasticity in patients with SCI (Benz *et al.*, 2005; Hsieh *et al.*, 2008). Researchers have also suggested the self-evaluation or self-descriptions of the impact of the spasticity in patients with SCI (Sköld, 2000; Lechner *et al.*, 2006; Priebe, 2006). Examples of self-ratings include the Penn Spasm

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Frequency Scale (PSFS) (Penn *et al.*, 1989), the Spinal Cord Injury Spasticity Evaluation Tool (SCI-SET) (Adams *et al.*, 2007), the Patient Reported Impact of Spasticity Measure (Cook *et al.*, 2007), measures of both spasticity severity using a visual analog scale (Sköld, 2000), or single-item ratings (Hagenbach *et al.*, 2007), and measures of spasticity impact on daily life (Lechner *et al.*, 2006). Especially SCI-SET and Patient Reported Impact of Spasticity Measure were suggested as the most promising tools for the assessment of the impact of spasticity on quality of life in patients with SCI (Balioussis *et al.*, 2014).

SCI-SET was developed by Adams *et al.* (2007) to measure the impact of spasticity on daily life in patients with SCI. SCI-SET takes into account both the problematic and the useful effects of spasticity, and fills a need for a valid and reliable self-report measure of spasticity in patients with SCI. The SCI-SET was translated and cross-culturally adapted to the Persian language by Ansari *et al.* (2016). They showed that the Persian version of SCI-SET is a reliable and valid instrument for evaluating the impact of spasticity on daily life in patients with SCI (Ansari *et al.*, 2016). If a measure is to be used in a country with different cultural values and different socio-economic standards, validation and reliability testing is recommended before a translated version of any measure can be used (Beaton *et al.*, 2000). We aimed to adapt the SCI-SET to the Turkish population and assess the reliability and cross-cultural validation of the Turkish translation of the Spinal Cord Injury Spasticity Evaluation Tool (SCI-SET$_T$) in patients with SCI.

Methods

Translation procedure

Translation of the English SCI-SET into Turkish was performed according to reports for translation and cultural adaptation (Beaton *et al.*, 2000; Wild *et al.*, 2005). Three medical doctors, who were fluent in English (lived at least 2 years in an English-speaking country), and a medical doctor who was born and was living in an English-speaking country took part in the translation process. Each provided an independent literal translation of the SCI-SET. After reconciliation of the three translations into a single translation, this final forward translation was translated back into the original language by the medical doctor, who was blinded to the original English SCI-SET. After harmonization, all individuals who took part in the translation process agreed on the prefinal version. Later on, the final version was pretested to ensure that the meanings of the words were understood. Feedbacks from patients about each question were evaluated. After the necessary adjustments had been made, the final SCI-SET$_T$ was created (Appendix 1).

Data collection

Sixty-six patients between the ages of 18 and 88 years with SCI, American Spinal Injury Association impairment scale grades from A to D with spasticity, and at least 6 months after injury were recruited from the inpatient rehabilitation unit of an education and research hospital. All patients were in a stable drug program; there was no initiation or dose change of oral anti spasticity-drug treatment within 30 days and no botulinum toxin injections were administered in the past 90 days before the assessment. Exclusion criteria included the presence of complications that affect spasticity (such as decubitus ulcers, heterotopic ossification, urinary tract infections, and any other infections) and inability to provide informed consent. Informed consent was obtained from each patient and all procedures were performed in accordance with the Helsinki Declaration of 1975 and approved by the local Institutional Clinical Research Ethics Committee.

Instrument

The SCI-SET was developed by Adams *et al.* (2007) and suggested to be useful in both research and clinical settings. It is a self-reported measure consisting of 35 questions to assess the degree to which spasticity has affected the life activities of patients with SCI over the past 7 days. Patients were asked to recall their past 7 days when rating spasticity. Responses were on a seven-point scale that ranges from $+3$ (extremely helpful) to -3 (extremely problematic). The SCI-SET total score was computed by summing all the responses from the applicable items and then dividing the sum by the number of applicable items (Adams *et al.*, 2007). SCI-SET was interviewer-administered or self-administered, and it takes $\sim$10 min to complete the questionnaire. It was created to be comprehensive but easy to understand for patients (Adams *et al.*, 2007).

Reliability and convergent validity

Participants rated the SCI-SET$_T$ at the same time of the day, 1 week apart, and test–retest reliability was investigated. Fifty-eight patients completed the second assessment. Five patients were excluded because of early discharge from the hospital and three patients were infected.

During the first administration of the SCI-SET$_T$, the Functional Independence Measure (FIM) motor subscale and the PSFS were performed and patients were asked to rate the overall severity of their spasticity on a six-point scale (0, no spasticity; 5, extreme spasticity) and the overall impact of spasticity on their daily life on a six-point scale (0, no impact; 5, extreme impact) in a random order.

The PSFS is a self-reported measure that was created to measure the effectiveness of intrathecal baclofen in the treatment of spasticity in patients with SCI (Hsieh *et al.*, 2008). It is a five-point scale that assesses spasm frequency (Penn *et al.*, 1989).

The FIM is a widely used subjective scale, consisting of 18 items, which assesses physical and cognitive disability in terms of burden of care in rehabilitation settings. The motor subscale of the FIM (13 items assessing self-care, sphincter control, transfers, and locomotion) is the most likely to be relevant to spasticity items (Dittmar, 1997; Kucukdeveci *et al.*, 2001; Adams *et al.*, 2007).

36-Item Short Form Health Survey (SF-36) is arguably the most widely used patient-reported outcome measure to assess health-related quality of life today. It is also applicable among patients with SCI (Forchheimer *et al.*, 2004).

Correlations between the first rates of the SCI-SET$_T$ and the PSFS, self-assessment of spasticity severity, self-assessment of spasticity impact, the FIM motor subscale, and SF-36 were investigated for the evaluation of convergent validity.

Data analysis

Statistical analyses were carried out using the IBM SPSS Statistics 22 software package (IBM Turk Limited Company, Istanbul, Turkey). For descriptive analyses, the results from patient's first rates of the SCI-SET were used. Cronbach's α coefficient was used for the assessment of internal consistency. The intraclass correlation coefficient (ICC) was used for the analyses of test–retest reliability. The ICC values were interpreted as follows: poor = < 0.40; fair = 0.40–0.59; good = 0.60–0.74; and excellent = 0.75–1.00 (Cicchetti, 1994; Kucukdeveci *et al.*, 2001). Spearman's rank correlation coefficient was used to identify the relationship of the SCI-SET$_T$ with the PSFS, self-assessment of spasticity severity, self-assessment of spasticity impact, and SF-36. Pearson correlation coefficient was used to assess the relationship of the SCI-SET$_T$ with the FIM motor subscale. A P value less than 0.05 was considered statistically significant.

Results

Patient demographics

The mean age of patients with SCI, 26 (39.4%) women and 40 (60.6%) men, was 44.06 ± 14.47 years. The total duration of SCI was 6–338 months. The most frequent etiologies of SCI were falls and traffic accidents, respectively. Forty-five patients were paraplegic and 21 patients were tetraplegic. The characteristics of the study population are presented in Table 1.

Table 1 Characteristics of the study population

Characteristics	*n* (%)
ASIA grade	
A	13 (19.7)
B	10 (15.2)
C	19 (28.8)
D	24 (36.4)
Etiology	
Traffic accidents	14 (21.2)
Violence	4 (6.1)
Falls	26 (39.4)
Diving	2 (3.0)
Tumor/infection	10 (15.1)
Sports	10 (15.2)
Spasticity medication	
Baclofen	20 (30.3)
Tizanidine	4 (6.1)
Diazepam	2 (3.0)
Education	
Illiterate	7 (10.6)
Primary/secondary school	46 (69.7)
High school	5 (7.6)
University	8 (12.1)

ASIA, American Spinal Injury Association.

Translation and adaptation

The procedure was applied according to reports for translation and cultural adaptation (Beaton *et al.*, 2000; Wild *et al.*, 2005). In the pilot testing phase, feedback from patients showed that the meanings of the words were understood. Patients easily filled the questionnaire after understanding the instructions. There was no difficulty throughout the process despite the social and cultural differences between the different speaking populations.

Internal consistency

SCI-SET$_T$ showed high internal consistency ($\alpha = 0.95$) similar to that ($\alpha = 0.90$) reported for the original English version, and ($\alpha = 0.86$) reported for the Persian version, confirming the questionnaire as a cohesive measure (Adams *et al.*, 2007; Ansari *et al.*, 2016).

Internal consistency and score distributions of the SCI-SET$_T$ are shown in Table 2.

Test–retest reliability and convergent validity

Excellent test–retest reliability was found, with an ICC = 0.80 (95% confidence interval: 0.68–0.87, $P < 0.001$).

There were statistically significant correlations between the SCI-SET$_T$ and both self-assessment of spasticity

Table 2 Internal consistency and score distributions of the Turkish version of the Spinal Cord Injury Spasticity Evaluation Tool

	SCI-SET$_T$ (first)	SCI-SET$_T$ (second)
Minimum	−2.14	−2.13
Maximum	0.90	0.86
Tetraplegia ($n = 21$) (mean ± SD)	−0.60 ± 0.79	−0.84 ± 0.83
Median	−0.32	−1.03
Cronbach's α	0.939	0.959
Minimum	−2.21	−2.05
Maximum	1.53	1.57
Paraplegia ($n = 45$) (mean ± SD)	−0.32 ± 0.79	−0.36 ± 0.77
Median	−0.06	−0.21
Cronbach's α	0.948	0.962
Minimum	−2.21	−2.13
Maximum	1.53	1.57
Total ($n = 66$) (mean ± SD)	−0.41 ± 0.80	−0.52 ± 0.81
Median	−0.14	−0.39
Cronbach's α	0.950	0.962

SCI-SET$_T$, Turkish version of the Spinal Cord Injury Spasticity Evaluation Tool.

severity ($r=-0.41$) and self-assessment of spasticity impact ($r=-0.47$) scores ($P<0.05$). There were no statistically significant correlations between the SCI-SET_T and the PSFS, and the FIM motor subscale. There was a statistically significant correlation between the SCI-SET_T and vitality scores of the SF-36 ($r=0.46$), ($P<0.05$).

Discussion

We cross-culturally adapted the SCI-SET to the Turkish language according to guidelines for the translation of self-report health questionnaires (Beaton *et al.*, 2000). Our results showed excellent test–retest reliability and high internal consistency. We also found statistically significant correlations between the SCI-SET_T and self-assessment of spasticity severity, and self-assessment of spasticity impact, but no significant correlations with the PSFS and the FIM motor subscale.

The SCI-SET is a self-report measure that assesses the impact of spasticity on daily life in patients with SCI, both positive and negative items (Adams *et al.*, 2007). Among the spasticity evaluation tools used in patients with SCI, SCI-SET is a practical, easy-to-administer tool that comprehends activity and participation restrictions. It is important to assess whether or not spasticity is disabling so that the right patients receive the right treatment at the right time. Mahoney *et al.* (2007) found that patients' experiences and concerns may not be appropriately captured by clinicians. Experiences and concerns of patients are also important to evaluate the efficacy of interventions; thus, SCI-SET serves a useful tool for assessing spasticity in patients with SCI.

The process of cross-cultural adaptation of an assessment tool is complex and involves more than just a simple translation. In our study, we followed the principles of good practice for the translation and cross-cultural adaptation of such tools to achieve experimental, semantic, and conceptual equivalence between the original questionnaire and the translated version.

Validation and reliability testing are also recommended if the assessment is to be used in a country with different cultural values, a different healthcare system, and a different socioeconomic standard adaptation (Beaton *et al.*, 2000; Wild *et al.*, 2005). With our study, we thus ensure that the SCI-SET_T is fully adapted to the Turkish culture.

Reliability is the degree to which an assessment tool produces stable and consistent results when used at different times or applied by different participants (Bellamy, 1994). The SCI-SET_T has been shown to be reliable as we found excellent test–retest reliability and high internal consistency. We confirmed that questions of SCI-SET_T are interrelated and consistent. Our results were similar to those found for the original English and Persian version items (Adams *et al.*, 2007; Ansari *et al.*, 2016).

If the translation and cultural adaptation process are performed in an appropriate manner, linguistic and cultural differences do not affect the outcome of the SCI-SET. Despite the lower education level of patients in our study and the Ansari *et al.* (2016) study than the Adams *et al.* (2007) study, excellent test–retest reliability was found in all three populations.

Convergent validity is the degree to which scores on a test correlate with scores on other tests that are designed to assess the same construct (Campbell and Fisk, 1959). Validity of the SCI-SET_T was supported by statistically significant correlations between the SCI-SET_T and self-assessment of spasticity severity, and self-assessment of spasticity impact. However, we did not find any significant correlations with the PSFS, although Adams *et al.* (2007) found statistically significant correlations between the SCI-SET_T and the PSFS. SCI-SET measures the perceived impact of spasticity on daily life despite hourly and daily fluctuations. However, PSFS measures the number of spasms experienced by patients within a 1 h period.

Moreover, we did not find any significant correlation between the SCI-SET_T and the FIM motor subscale as found in the studies by Adams *et al.* (2007) and Ansari *et al.* (2016). Although the motor subscale of the FIM was suggested to be relevant to spasticity (Dittmar, 1997), the FIM items are likely to be affected by neurologic levels and impairments. Our results support the findings of the studies of Adams *et al.* (2007) and Ansari *et al.* (2016) that general measures of function may be insensitive as indicators of change in spasticity. However, the Spinal Cord Independence Measure in which the items in FIM were refined for patients with SCI (Catz *et al.*, 1997; Kesiktas *et al.*, 2012) would be better for use in our study. This was a limitation of our study.

Quality of life was included as an important domain to evaluate the impact of spasticity interventions on participation and the patient's environment (Pereira *et al.*, 2015). We only found a correlation between the vitality scores of the SF-36 and SCI-SET_T in our study. Twenty of the 66 patients scored the SF-36. The results would have been different if the number of patients had been higher.

Subjective information reported from patients with SCI about their health and well-being is necessary to guide treatment and interventions. Moreover, it is suggested that spasticity intervention trials should include objective, subjective, and functional assessments (Priebe, 2006). Hence, a combination of tools is needed to effectively evaluate, treat, and manage spasticity in patients with SCI. SCI-SET may serve as a complementary tool to clinical scales in SCI.

Conclusion

SCI-SET$_T$ has been shown to be reliable and valid, and has been suggested to be a useful tool to assess the impact of spasticity on daily life in Turkish patients with SCI.

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Conflicts of interest

There are no conflicts of interest.

Appendix

Appendix 1: Turkish version of the Spinal Cord Injury Spasticity Evaluation Tool (SCI-SET$_T$).

SPİNAL KORD YARALANMASI SPASTİSİTE DEĞERLENDİRME ÖLÇEĞİ

Lütfen aşağıdaki sorulara son 7 gün içinde spastisite şikayetinizin hayatınızı nasıl etkilediğini belirten uygun cevabı seçiniz.

Spastisite şikayeti; (a) Kontrol edilemeyen, istemsiz kas kontraksiyonları veya hareketleri (yavaş veya hızlı, kısa veya uzamış) (b) İstemsiz, tekrarlı, hızlı kas hareketleri (yukarı aşağı; yan-yan) (c) Kas sertliği (d) Spazm (kasılma) olarak ifade edebileceklerinizi.

Soru sizinle alakalı değilse lütfen haber veriniz.

−3: Aşırı derecede problemli	0: Etki yok	+1: Biraz yardımcı
−2: Orta derecede problemli		+2: Orta derecede yardımcı
−1: Biraz problemli		+3: Aşırı derecede yardımcı

Son 7 gün sürecinde spastisite şikayetiniz aşağıdakileri nasıl etkiledi?

(1) Banyo yapmanız.
(2) Giyinip/soyunmanız.
(3) Transferleriniz (bir yerden bir yere geçmeniz) (yatağa ve yataktan sandalyeye, araca).
(4) Oturma pozisyonunuz (sandalyede vb.).
(5) Yemek hazırlamanız.
(6) Yemek yemeniz.
(7) Sıvı içimi.
(8) El ve parmak hareketleriniz (yazı yazma, bilgisayar kullanma vb.).
(9) Ev işlerini yapma beceriniz.
(10) Hobileriniz/eğlence faaliyetleriniz.
(11) Sosyal gezintiler.
(12) Ayakta durabilme/yük verebilme.
(13) Yürümeniz.
(14) Dengede durabilmeniz/dengeniz.
(15) Kas yorgunluğunuz.
(16) Eklemlerinizin esnekliği (bükülebilirliği).
(17) Tedavi/egzersiz rutininiz.
(18) El ile tekerlekli sandalye kullanımınız.
(19) Akülü tekerlekli sandalye kullanımınız.
(20) Yatış pozisyonunuz (yatakta vb.).
(21) Yatakta pozisyonunuzu değiştirebilmeniz.
(22) Uykuya dalabilmeniz.
(23) Uyku kaliteniz.
(24) Cinsel hayatınız.
(25) Keyfinizin kaçtığını/sıkıldığınızı hissetmeniz.
(26) Mahçup hissetmeniz.
(27) Sosyal konforunuz.
(28) Fiziksel konforunuz.
(29) Ağrınız.
(30) Düşme endişeniz.
(31) Yaralanma endişeniz.
(32) Başka birini kaza ile yaralama endişeniz.
(33) Konsantre olabilmeniz.
(34) Vücudunuza hakim olabilme hissiniz.
(35) Yardım isteme ihtiyacınız.

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