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ORIGINAL ARTICLE

Cross-cultural adaptation of the German version of the spinal stenosis measure

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Abstract
Purpose To validate the German version of the spinal stenosis measure (SSM), a disease-specific questionnaire assessing symptom severity, physical function, and satisfaction with treatment in patients with lumbar spinal stenosis.
Methods After translation, cross-cultural adaptation, and pilot testing, we assessed internal consistency, test–retest reliability, construct validity, and responsiveness of the SSM subscales. Data from a large Swiss multi-center prospective cohort study were used. Reference scales for the assessment of construct validity and responsiveness were the numeric rating scale, pain thermometer, and the Roland Morris Disability Questionnaire.
Results One hundred and eight consecutive patients were included in this validation study, recruited from five different centers. Cronbach's alpha was above 0.8 for all three subscales of the SSM. The objectivity of the SSM was assessed using a partial credit approach. The model showed a good global fit to the data. Of the 108 patients 78 participated in the test–retest procedure. The ICC values were above 0.8 for all three subscales of the SSM. Correlations with reference scales were above 0.7 for the symptom and function subscales. For satisfaction subscale, it was 0.66 or above. Clinically meaningful changes of the reference scales over time were associated with significantly more improvement in all three SSM subscales ($p < 0.001$).
Conclusion The proposed version of the SSM showed very good measurement properties and can be considered validated for use in the German language.

Keywords Spinal stenosis · Questionnaire · Cross-cultural · Validation study · Rasch analysis · German language

Introduction

Degenerative lumbar spinal stenosis is a common disease in elderly patients defined by diminished space for the neural and vascular elements in the central canal of the lumbar spine secondary to degenerative changes in the facet joints, ligaments, vertebrae, and intervertebral discs [1, 2]. When symptomatic, patients complain of pain in the buttocks and lower extremities with or without low back pain provoked by walking or extended standing that is relieved by rest and forward bending.

The Spinal Stenosis Measure (SSM) is a disease-specific questionnaire assessing symptom severity, physical function, and satisfaction with treatment of lumbar spinal stenosis [3]. The questionnaire was developed and first validated by Stucki et al. [3] and has been used in various studies investigating treatment of spinal stenosis. The SSM is recognized as a useful tool to quantify, in addition to pain and disability, the specific neuroischemic characteristics and adverse effects on walking capacity associated with degenerative lumbar spinal stenosis [4, 5]. To date, the SSM exists in an English, Slovenian [6], and

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Norwegian version [7], but a German version has not been validated.

The aim of this study was to translate and cross-culturally adapt the English SSM into German, and to test the German version for psychometric properties in terms of its reliability and validity.

Methods

This research is part of a multi-center prospective cohort study in Switzerland investigating the prognosis and treatment of patients with lumbar spinal stenosis [8]. The study was approved by the local ethical committee and conducted in accordance with the Declaration of Helsinki [9]. All patients received written and oral information about the study and gave their written consent to participate.

Eligibility criteria and patients

Patients were recruited during consultations in the Rheumatology and Spine Surgery Units in five hospitals located in the Cantons of Zurich and Lucerne, Switzerland. Inclusion criteria were: (1) age $\geq$50 years; (2) uni- or bilateral neurogenic claudication (defined by pain in the buttocks and/or lower extremities provoked by walking or extended standing and relieved by rest and/or bending forward); (3) verified spinal stenosis (central or lateral verified by computer tomography or magnetic resonance imaging); (4) anticipated life expectancy more than 1 year; (5) able to give informed consent; (6) available for follow-up; and (7) able to complete questionnaires in German.

Exclusion criteria were: red flags (e.g., cauda equina syndrome, infection), current vertebral fracture, significant deformity (>15° lumbar scoliosis), or clinically relevant peripheral arterial disease (confirmed by a vascular specialist).

For the validation study, all consecutive patients fulfilling the following criteria were included: complete data at baseline and 6 months follow-up. Patients were invited to participate in a test–retest procedure at 6 months for the three SSM subscales.

Questionnaire

The SSM (also known as the Spinal Stenosis Measure, Zurich Claudication Questionnaire, or Brigham Spinal Stenosis Questionnaire) is a reproducible, valid, internally consistent, self-administered questionnaire that is responsive to clinical change and validated in English [3, 10] and other languages [6, 7]. The three subscales are the SSM symptom severity scale (SSM symptom, 7 items), the SSM physical function scale (SSM function, 5 items), and the SSM satisfaction scale (6 items). The SSM symptom scale consists of a pain subdomain (3 items) and a neuroischemic subdomain (4 items). Each item is rated on a Likert scale—the SSM symptom: no (1) to very severe symptoms (5); SSM function: yes, comfortably (1) to no, could not perform (5); SSM satisfaction: very satisfied (1) to very dissatisfied (4).

The unweighted mean was calculated for all subscales of all answered questions if fewer than two items were missing in the SSM function and SSM satisfaction, and fewer than three items were missing in the SSM symptom.

Translation and cross-cultural adaptation

A sequential forward and backward translation approach was used following international guidelines [11]. Two professional translators independently translated the English language version of the SSM into German. In a consensus meeting with the translators, two rheumatologists and a methodologist agreed on the first German versions for these formats. We then pilot tested these versions with five patients recruited from a rheumatology outpatient clinic to identify difficulties in understanding. When the translation team considered more than one possible version, the different versions were tested. A third professional English translator, unaware of the original English SSM, performed a back translation of the German SSM into the source language (English). The back translation was compared by the two rheumatologists and a methodologist with the English SSM to check for and solve conceptual discrepancies.

Procedure and measurements

All patients participating in the prospective cohort study completed baseline information about socio-demographic characteristics, symptoms, clinical examination, and treatments for lumbar spinal stenosis received within the last 6 months. The SSM and the following information were collected: pain intensity (numeric rating scale, NRS [12, 13], pain thermometer [14]); functional disability [German version of the Roland Morris Disability Questionnaire (RMQ)] [15–17]; and psychosocial factors [German version of the Fear Avoidance Beliefs Questionnaire of physical activity (FABQ-P)] [18], Pain Self-Efficacy Questionnaire, German FESS [19]. Unless otherwise stated, data at 6 months or change from baseline to 6 months were used for the validation, as we considered these observations more stable and reliable than those collected at baseline, when many patients were at the beginning of a new therapy.

Sample size calculation

As recommended by Terwee et al. [20], we aimed to include a minimum of 50 patients for assessing construct validity, reproducibility, and floor or ceiling effects; and a minimum of 100 patients for assessing internal consistency.

Descriptive statistics

For continuous data, median and interquartile ranges are given. We examined the distribution of SSM subscales for potential floor and ceiling effects at baseline and at 6 months visually, using histograms.

Internal consistency

Intercorrelation of the items in the subscales was assessed by using Cronbach's alpha. We evaluated the objectivity of the scale by using a more sophisticated approach, the partial credit model (PCM), to address responses recorded in ordered categories. The PCM is special case of the Rasch models [21] which quantifies the patient-specific influence on item responses ([22], p. 3). We assessed the global goodness of fit with the Andersen likelihood ratio test [23]. Item fit was addressed with a Chi-squared test. We examined the SSM symptom, function, and satisfaction, and the two subdomains of pain and neuroischemic pain for differential item functioning (DIF) with respect to the grouping variables of age, gender, and level of education. We estimated the threshold parameters for the latent dimensions of the answer categories within each item to determine whether they are ordered increasingly.

Test–retest reliability

Reproducibility (test–retest) concerns the degree to which repeated measurements in stable persons provide similar answers [20]. All patients who completed 6 months follow-up were invited to participate in the test–retest procedure. Patients who completed a retest questionnaire between 3 and 7 days after the 6 months follow-up were included in this analysis.

Test–retest reliability was established by using the Spearman correlation coefficient and the intraclass correlation coefficient (ICC) [24]. Bland and Altman plots were used for graphical representation of the repeated measures.

Construct validity

Construct validity refers to the extent to which scores on the SSM relate to other widely accepted measures in theoretically related or unrelated concepts [20]. We hypothesized a priori that variables from validated tools representing the same dimension of the disease would be more correlated with SSM subscales than variables representing different dimensions. Hence, we expected a strong correlation between the SSM symptom scale and pain (NRS and feeling thermometer) and between SSM function and disability (RMQ). For the SSM satisfaction scale, we hypothesized an inverse association at 6 months with disability (RMQ) and pain after treatment (NRS and feeling thermometer). In contrast, we expected a low to moderate correlation between the SSM subscales and psychosocial variables (FABQ-P, FESS). For the assessment of construct validity, Spearman correlation coefficients were used.

Responsiveness

The ability of the SSM to detect clinically important changes over time (responsiveness) was assessed comparing the SSM difference baseline to 6 months follow-up to a clinically meaningful important difference (CMID) in RMQ and NRS, respectively, by using the Wilcoxon test [20, 25]. A CMID in RMQ and NRS is achieved if a 30 % reduction is observed [17]. Patients were split into two groups: one with CMID, and without CMID in NRS at 6 months, and they were compared with respect to changes in the SSM symptom scale. The same comparison was made for CMID in RMQ and changes in the SSM function scale.

For the SSM satisfaction scale at 6 months, we hypothesized an association with a decrease in disability (RMQ) and pain after treatment (NRS). Patients with and without CMID in RMQ or NRS were compared with respect to SSM satisfaction by using the Wilcoxon test.

We expected the changes in the SSM symptom, function, and satisfaction scales to be weakly correlated with the longitudinal changes in the psychosocial variables (i.e., FABQ-P, FESS). Comparisons of the SSM subscales and the psychological variables were performed with Spearman correlation coefficients.

Statistical analysis

Correlation coefficients and the ICC are reported including 95 percent confidence interval (95 % CI). The 95 % CI for Spearman correlation coefficient were derived with bootstrapping based on 1,000 replicates. Strength of agreement for the correlation coefficient and the ICC was expressed as follows: strong ($\geq$0.70), moderate (>0.5–<0.7), weak ($\leq$0.5) [20]. For analysis, the statistical software R was used [26]. The PCM was fitted with the eRm package [27].

Table 1 Baseline characteristics ($n = 108$)

Variable	Median	IQR
Gender	Males: 60 (56 %)	
Age (year)	Median: 73.5	IQR: 68.0–79.0
Treatment before inclusion in the study		
% Surgery	Yes: 4 (4 %)	
% Epidural injections of steroids	Yes: 30 (28 %)	
Nationality	Swiss: 102 (94 %)	Other: 6 (6 %)
RMQ (0–24)	Median: 12.5	IQR: 7.0–16.0
FABQ-physical (0–24)	Median: 16.0	IQR: 9.3–21.0
FESS (10–60)	Median: 29.0	IQR: 20.0–40.0
Pain thermometer (0–100)	Median: 63.0	IQR: 48.5–80.0
NRS (0–10)	Median: 6.0	IQR: 4.8–8.0

Mean and interquartile range for continuous variables, number and percent for categorical variables

RMQ Roland Morris Questionnaire (score 0–24), *NRS* numeric rating scale (score 0–10), *FABQ-P* fear avoidance physical function subscale (score 0–24), *FESS* pain self-efficacy questionnaire (score 10–60)

Results

Patients and measurements

Of the 372 patients enrolled in the study as of May 2013, 231 had completed a 6 months follow-up assessment. For this validation study, 108 patients (47 %) with lumbar spinal stenosis fulfilled the inclusion criteria (baseline characteristics Table 1). The German version of the SSM ("Appendix 1") was well understood. Nearly all patients answered a complete set of SSM questions. In total only four questions remained unanswered (once each of the following items: SSM symptom and function item 2, 4, 9 and SSM satisfaction item 3). Visual inspection of the histograms of the SSM revealed no floor or ceiling effects in any subscale at baseline and a potential floor effect of the function scale at 6 months ("Appendix 2"). When this result was compared to the histogram of the RMQ at 6 months, we found the same floor effect.

Internal consistency

The results are summarized in Table 2. Cronbach's alpha at 6 months for the SSM symptom was 0.83, for the SSM

Table 2 Measurement properties of the SSM subscales with 95 % confidence interval (95 % CI)

Patient	Analysis	SSM subscales		
		Symptoms 7 items	Function 5 items	Satisfaction 6 items
$n = 108$	Internal consistency Cronbach's alpha	0.83	0.86	0.87
$n = 108$	PCM, global fit (p value)	0.23	0.42	0.10
$n = 78$	Test–retest reliability Spearman correlation	0.86 (0.75; 0.92)	0.82 (0.70; 0.91)	0.87 (0.77; 0.94)
$n = 78$	Test–retest reliability ICC	0.87 (0.81; 0.92)	0.81 (0.71; 0.87)	0.90 (0.84; 0.93)
$n = 108$	NRS Spearman correlation	0.73 (0.60; 0.82)	0.63 (0.49; 0.74)	0.73 (0.59; 0.84)
$n = 108$	Feel thermometer Spearman correlation	0.73 (0.60; 0.83)	0.63 (0.48; 0.76)	0.71 (0.56; 0.82)
$n = 108$	RMQ Spearman correlation	0.63 (0.47; 0.75)	0.70 (0.56; 0.80)	0.66 (0.51; 0.78)
$n = 108$	FESS Spearman correlation	0.53 (0.36; 0.66)	0.59 (0.43; 0.73)	0.61 0.45; 0.75)
$n = 108$	FABQ-P Spearman correlation	0.40 (0.20; 0.56)	0.51 (0.33; 0.66)	0.49 (0.32; 0.62)
$n = 108$	Floor or ceiling effect			
	Baseline	No	No	–
	6 months	No	Yes (floor)	No
$n = 108$	CMID RMQ difference (Wilcoxon test)	Δ basel. − 6 mo. 0.71 ($p < 0.001$)	Δ basel. − 6 mo. 0.80 ($p < 0.001$)	6 mo. 0.67 ($p < 0.001$)
$n = 108$	CMID NRS difference (Wilcoxon test)	Δ basel. − 6 mo. 0.86 ($p < 0.001$)	Δ basel. − 6 mo. 0.60 ($p < 0.001$)	6 mo. 0.67 ($p < 0.001$)
$n = 108$	FESS Spearman correlation	0.35 (0.16; 0.51)	0.52 (0.36; 0.66)	0.32 (0.15; 0.48)
$n = 108$	FABQ-P Spearman correlation	0.28 (0.11; 0.44)	0.39 (0.19; 0.57)	0.25 (0.06; 0.42)

CMID clinically meaningful change, *RMQ* Roland Morris Questionnaire (score 0–24), *NRS* numeric rating scale (score 0–10), *FABQ-P* fear avoidance physical function subscale (score 0–24), *FESS* pain self-efficacy questionnaire (score 10–60), *mo.* months, *basel.* baseline

function 0.86, and for the SSM satisfaction 0.87. For the subdomain pain, the Cronbach's alpha was 0.90 and for the neuroischemic subdomain it was 0.69.

The PCM showed a good global fit of the data in all its subscales (p values ranging from 0.06 to 0.42). When we addressed the item fit of the scales, we found items 5 and 7 ("Appendix 1") of the SSM symptom scale to be problematic ($p < 0.05$ in Chi-squared test). We found no more significant deviations from item fit expectations in the other scales (Table 3). Grouping variables for potential DIF were age, gender, and level of education. We found no DIF in any of the scales, except for gender DIF ($p = 0.02$, likelihood ratio test) in the SSM function (Table 3). The thresholds of the latent dimensions of the response categories in all scales were examined and displayed graphically. All thresholds were ordered, indicating good response patterns in the items. Figure 1 shows the category characteristic curves for the three items of the pain subdomain as an example.

Test–retest reliability

Seventy-eight patients participated in the test–retest procedure (characteristics in "Appendix 3"). Correlation analysis (Spearman correlation coefficient) for the SSM symptom, function, and satisfaction scale was 0.86, 0.82, and 0.87 respectively (Table 2). The correlation coefficient for the subdomains pain and neuroischemic was 0.78 and 0.88, respectively. The intraclass correlation coefficient in the ICC analysis for the SSM symptom, function, and satisfaction scale was 0.87, 0.81, and 0.90, respectively. Bland and Altman plots were examined for visual representation of the relationships ("Appendix 4").

Construct validity

We found a strong correlation between the SSM symptom and pain scale (NRS and pain thermometer: Spearman correlation 0.73, Table 2). A strong correlation was found between the SSM function scale and RMQ (Spearman correlation 0.70). The correlation was moderate to strong between the SSM satisfaction scale and RMQ (0.66), NRS (0.73), and pain thermometer (0.71). As expected, the correlations between the SSM subscales and the psychological measures were weak to moderate (FESS and FABQ-physical below 0.60).

Responsiveness

Out of 108 patients, 52 (48 %) had a CMID in NRS and 45 (42 %) in RMQ over 6 months. The improvement in SSM symptom scale was significantly larger in patients with CMID in NRS compared to patients without CMID in the NRS (mean difference of change = 0.86, $p < 0.001$). We found similar results for SSM function scale and RMQ (mean difference of change = 0.80, $p < 0.001$). For the satisfaction subscale, there was again a significant difference between both CMID in NRS and RMQ.

As hypothesized, we found correlations below 0.5 between the psychosocial variables (FESS, FABQ-physical).

Discussion

In patients with lumbar spinal stenosis, the German version of the SSM is a well-understood and reproducible tool to measure symptoms and disability. The test results were reproducible, and the subscales showed a high internal consistency and a good responsiveness. Reliability in the partial credit analysis was good because of good global, item, and person fit. Age, gender, and education did not influence the response to items. The global SSM symptom score, however, was less consistent.

Comparison with the literature

Internal consistency, test–retest reliability, and responsiveness for the German version of the SSM were similar to

Table 3 Results of fitting the partial credit model (PCM) to the SSM data

	SSM symptom	Pain subdomain	Neuroischemic subdomain	SSM function	SSM satisfaction
Global fit LR* test (p value)	0.23	**	0.06	0.42	0.10
Item fit problems (χ^2 test, p value <0.05)	Item 5, 7	No problematic item fit	No problematic item fit	No problematic item fit	No problematic item fit
DIF (LR test, p value)					
Age >70 years	0.92	0.71	0.94	0.07	0.20
Gender	0.27	0.08	0.22	0.02	0.81
Education	0.90	0.64	0.84	0.44	0.97
Ordered thresholds	Yes	Yes	Yes	Yes	Yes

* Andersen likelihood ratio test

** No appropriate response patterns to conduct the analysis

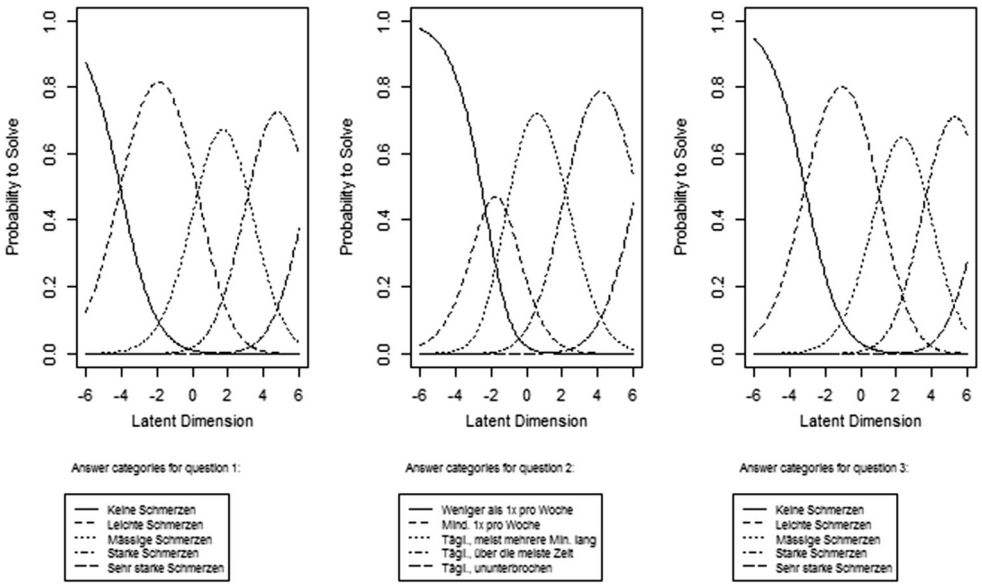

Fig. 1 Category characteristic curves for the three items in pain subdomain of the SSM symptom scale. The thresholds of the answer categories for all three items are ordered as the lines intersect increasingly from answer category 1 to category 5

other validation studies [3, 7]. We believe this is the first study that used the PCM and item response theory together with classical approaches to evaluate all three subscales of the SSM. Comer et al. [28] used a Rasch/partial credit analysis alone. While they found that the SSM function performed well as unidimensional scale, they found the SSM symptom scale to be multidimensional. Stucki et al. [3] described two subdomains (neuroischemic and pain) in the original validation and found a lower internal consistency for the neuroischemic subdomain compared to the pain subdomain (Cronbach's alpha 0.63 vs. 0.73). Similarly, we found a good global, item, and person fit for the SSM function scale and the greatest variance in several items of the SSM symptom scale. When the pain and the neuroischemic subdomain were analyzed separately, we found a good item and personal fit for the pain subdomain. For the neuroischemic subdomain, we found no deviations from the PCM assumptions indicating the objectivity of the measure.

Strength and limitations

We followed current guidelines for the cross-cultural validation, complied with sample size requirements, and used the PCM in addition to conventional statistical methods to investigate the reliability of the SSM. However, a potential limitation might be that by choosing 6 months follow-up data for the validation procedure, a potential floor effect in the SSM function scale was observed. Further, the wording of questions was adapted for a Swiss German population. Therefore, additional language adaptation for some areas in Germany might be warranted.

Implication for research

The SSM can be used in research to assess pain, physical function, and satisfaction in patients with lumbar spinal stenosis. We suggest reporting the subdomains of the SSM symptom scale separately. This will allow clinicians and researchers to see the differences in the neuroischemic and pain symptoms. Research should aim to increase knowledge about the neuroischemic component in patients with lumbar spinal stenosis. Further, the correlation between findings in imaging studies and symptoms reported needs to be investigated. Recently, a study showed that less than two out of ten patients with severe spinal stenosis in imaging studies report symptoms [29].

Implication for clinical practice

The German version of the SSM is an easy to use, well-understood self-reported questionnaire that assesses symptoms, function, and satisfaction in patients with lumbar spinal stenosis.

Conclusion

The proposed version of the SSM showed very good measurement properties and can be considered validated for use in the German language. We suggest reporting the subdomains for pain and neuroischemic symptoms separately. This is consistent with the findings in validation studies of the English version.

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Conflict of interest The authors of this work have no conflict of interest to declare.

Appendices

Appendix 1: German version of the spinal stenosis measure (SSM)

(a) SSM symptom subscale:

Beantworten Sie bitte folgende Fragen bezogen auf den letzten Monat:

1. Wie würden Sie die Schmerzen beschreiben, die Sie durchschnittlich im Rücken, im Gesäss und ausstrahlend in die Beine verspürt haben?
keine Schmerzen
leichte Schmerzen
mässige Schmerzen
starke Schmerzen
sehr starke Schmerzen

2. Wie oft hatten Sie Schmerzen im Rücken, im Gesäss oder in den Beinen?
weniger als einmal pro Woche
mindestens einmal pro Woche
täglich, meistens mehrere Minuten lang
täglich, über die meiste Zeit
täglich, ununterbrochen

3. Wie würden Sie die Schmerzen in Ihrem Rücken oder im Gesäss beschreiben?
keine Schmerzen
leichte Schmerzen
mässige Schmerzen
starke Schmerzen
sehr starke Schmerzen

4. Wie würden Sie die Schmerzen in Ihren Beinen und Füssen beschreiben?
keine Schmerzen
leichte Schmerzen
mässige Schmerzen
starke Schmerzen
sehr starke Schmerzen

5. Hatten Sie Taubheitsgefühle oder Ameisenkribbeln in Ihren Beinen oder Füssen?
gar nicht
leicht
mässig
stark
sehr stark

6. Stellten Sie eine Muskelschwäche in Ihren Beinen oder Füssen fest?
gar nicht
leicht
mässig
stark
sehr stark

7. Litten Sie unter Gleichgewichtsstörungen?
Nein, ich hatte keine Gleichgewichtsstörungen
Ja, zeitweise hatte ich Gleichgewichtsstörungen oder das Gefühl, keinen sicheren Stand zu haben
Ja, ich habe oft Gleichgewichtsstörungen oder das Gefühl, keinen sicheren Stand zu haben

(b) SSM function scale subscale:

8. Wie weit konnten Sie am Stück laufen?
Mehr als 3 km
Mehr als 200 m aber weniger als 3 km
Mehr als 15 m, aber weniger als 200 m
Weniger als 15 m

9. Sind Sie zum Vergnügen draussen spazieren gegangen?
ja, problemlos
ja, aber teilweise mit Schmerzen
ja, aber immer mit Schmerzen
nein

10. Haben Sie Lebensmittel- oder andere Einkäufe erledigen können? Könnten Sie Lebensmittel- oder andere Einkäufe erledigen, wenn Sie müssten?
ja, problemlos
ja, aber teilweise mit Schmerzen
ja, aber immer mit Schmerzen
nein

11. Konnten Sie in den Wohnräumen Ihres Hauses oder Ihrer Wohnung umher laufen?
ja, problemlos
ja, aber teilweise mit Schmerzen
ja, aber immer mit Schmerzen
nein

12. Konnten Sie von Ihrem Schlafzimmer ins Bad laufen?
ja, problemlos
ja, aber teilweise mit Schmerzen
ja, aber immer mit Schmerzen
nein

(c) SSM satisfaction subscale:

In den folgenden Fragen werden Sie nach Ihrer Zufriedenheit mit der Therapie gefragt. Therapie kann bedeuten dass Sie operiert wurden, Medikamente erhielten oder eine Physiotherapie verordnet bekamen. Keine Therapie kann medizinisch gesehen auch eine Therapie sein. Bitte beantworten Sie die Fragen in jedem Falle, auch wenn Sie keine Therapie erhielten. Beantworten Sie bitte folgende Fragen bezogen auf den letzten Monat.

Wie zufrieden sind Sie mit …

1. …dem Gesamtergebnis Ihrer Operation/der Therapie?
Sehr zufrieden
Einigermassen zufrieden
Etwas unzufrieden
Sehr unzufrieden

2. …dem Rückgang der Schmerzen nach der Operation/der Therapie?
Sehr zufrieden
Einigermassen zufrieden
Etwas unzufrieden
Sehr unzufrieden

3. …Ihrem Gehvermögen nach der Operation/der Therapie
Sehr zufrieden
Einigermassen zufrieden
Etwas unzufrieden
Sehr unzufrieden

4. …Ihrer Fähigkeit, Haus- und Gartenarbeiten sowie Tätigkeiten am Arbeitsplatz zu verrichten?
Sehr zufrieden
Einigermassen zufrieden
Etwas unzufrieden
Sehr unzufrieden

5. …Ihrer Kraft in den Oberschenkeln, Beinen und Füssen?
Sehr zufrieden
Einigermassen zufrieden
Etwas unzufrieden
Sehr unzufrieden

6. …Ihrem Gleichgewichtssinn oder der Stabilität in Ihren Füssen?
Sehr zufrieden
Einigermassen zufrieden
Etwas unzufrieden
Sehr unzufrieden

Appendix 2

See Fig. 2.

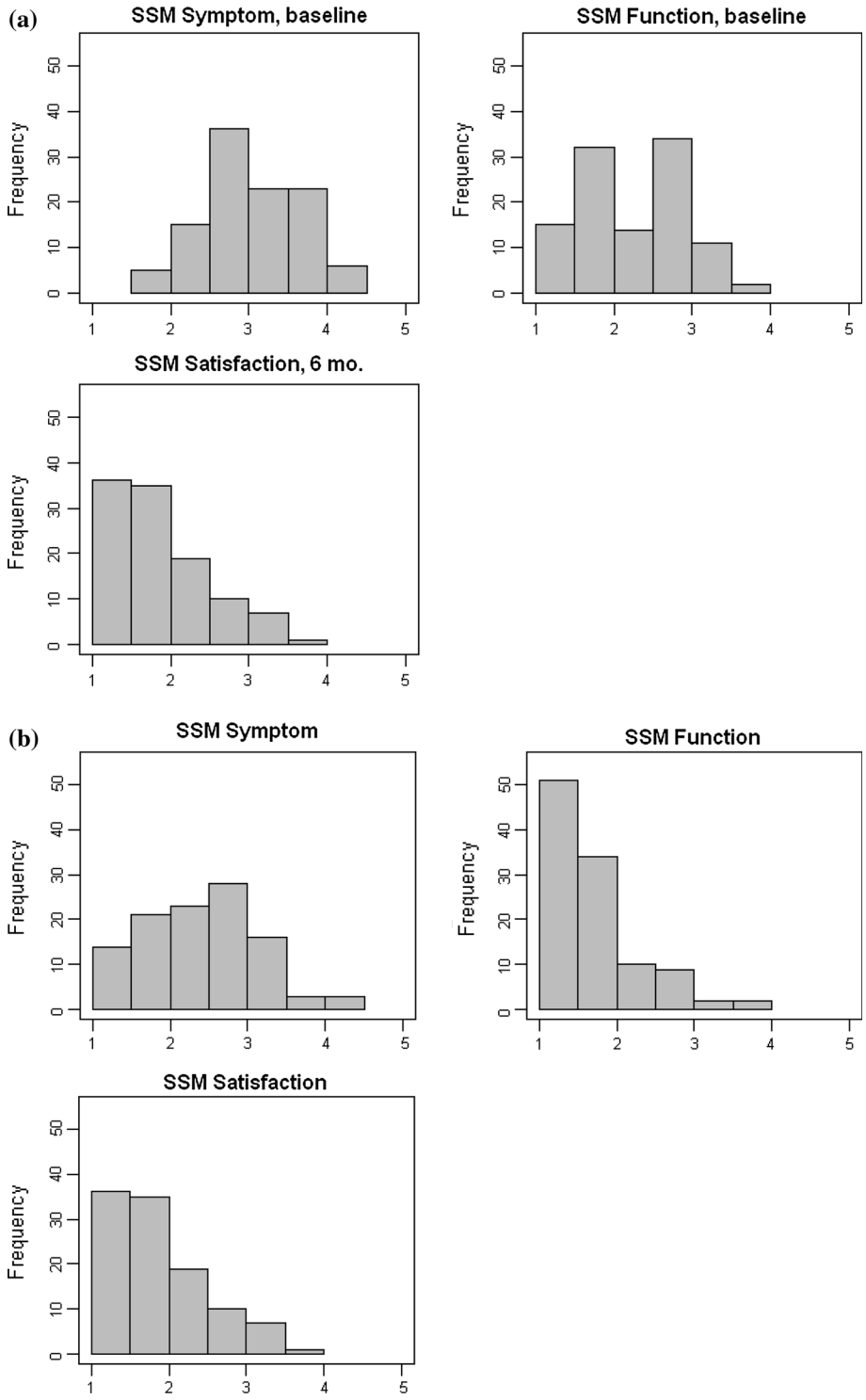

Fig. 2 Histograms for the assessment of potential floor and ceiling effects in the three SSM subscales at **a** baseline and **b** 6 months. *X*-axis of all histograms shows the range of values for the SSM subscales; on the *y*-axis the frequency of observed values is depicted

Appendix 3

See Table 4.

Table 4 Characteristics of the 78 test–retest patients at 6 months

Variable	Median	IQR
Gender	53 % male	47 % female
Age (year)	Median: 73	IQR: 68–77
Diagnostic criteria		
% Operated before baseline	7 % yes	93 % no
% Infiltrated before baseline	49 % yes	51 % no
Nationality	93 % Swiss	7 % other
RMQ (0–24)	Median: 13	IQR: 8–16
FABQ-Physical (0–24)	Median: 17.5	IQR: 11–22
NRS (0–10)	Median: 6	IQR: 5–8

Percentages are given for the categorical variables, median and interquartile range for the continuous variables

RMQ Roland Morris Questionnaire (score 0–24), *NRS* numeric rating scale (score 0–10), *FABQ-P* fear avoidance physical function subscale (score 0–24), *FESS* pain self-efficacy questionnaire (score 10–60)

Appendix 4

See Fig. 3.

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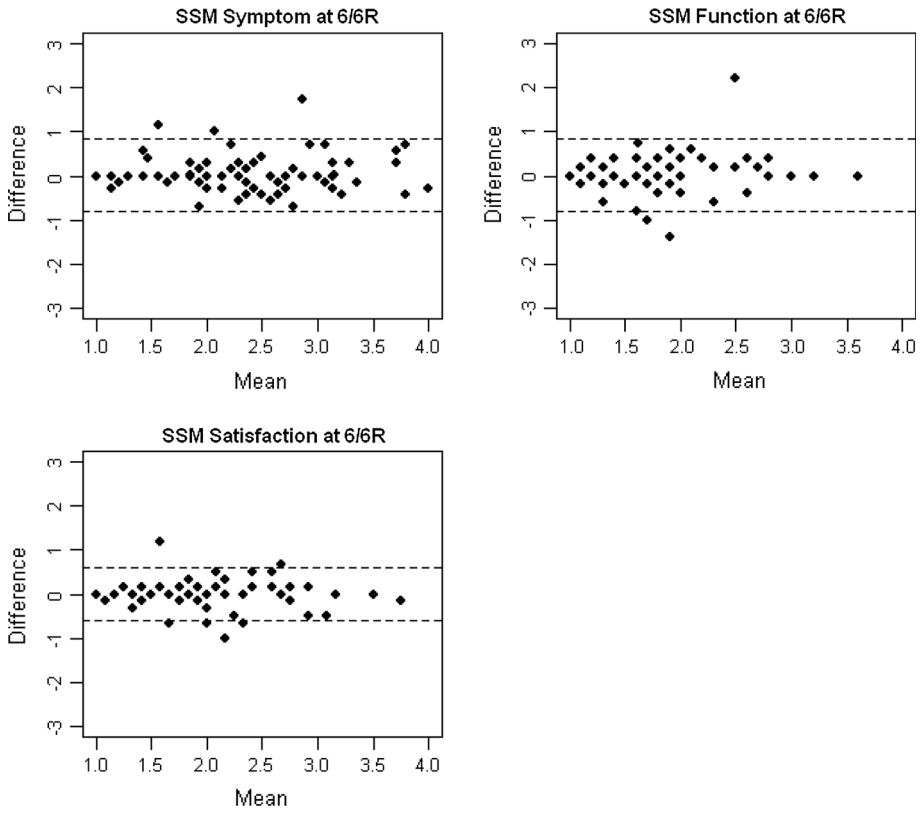

Fig. 3 Bland and Altman plots for test–retest measurements at 6 months for the three subscales of the SSM

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