Eur Spine J (2011) 20:1751–1756
DOI 10.1007/s00586-011-1872-9

ORIGINAL ARTICLE

Validation of the Korean version of the Scoliosis Research Society-22 questionnaire

Jung Sub Lee · Dong Ho Lee · Kuen Tak Suh · Jeung Il Kim · Jong Min Lim · Tae Sik Goh

Received: 8 December 2010 / Revised: 16 May 2011 / Accepted: 29 May 2011 / Published online: 14 June 2011

Abstract
Introduction We evaluated the reliability and validity of an adapted Korean version of the Scoliosis Research Society-22 (SRS-22) questionnaire.
Materials and methods Translation/retranslation of the English version of SRS-22 was conducted, and all steps of the cross-cultural adaptation process were performed. The Korean version of the SRS-22 questionnaire and the previously validated Short Form-36 (SF-36) outcome instruments were mailed to 102 patients who had been treated surgically for idiopathic scoliosis. Eighty-two patients responded to the first mailing of questionnaires and 64 of the first-time responders returned their second survey. The average age of the 64 patients (56 females and 8 males) was 18.3 years. Reliability assessment was determined by estimating Cronbach's α and intraclass correlation coefficient (ICC), respectively. Concurrent validity was evaluated by comparing SRS-22 domains with relevant domains in the SF-36 questionnaire using Pearson's correlation coefficient.
Results The study demonstrated satisfactory internal consistency (Cronbach's $\alpha = 0.80$–0.89) for function/activity, pain and mental health, and good consistency (Cronbach's $\alpha = 0.50$–0.79) for the remaining domains. The ICC of all domains demonstrated excellent test/retest reproducibility. Considering concurrent validity, 3 domains showed excellent correlation, 9 domains good, 25 domains moderate, and 3 domains poor.
Conclusion The adapted Korean version of the SRS-22 questionnaire was successfully translated and showed acceptable measurement properties, and as such, is considered suitable for treatment outcome assessments in the Korean-speaking patients with idiopathic scoliosis.

Keywords Idiopathic scoliosis · Scoliosis Research Society-22 · Korean version

J. S. Lee (✉) · J. I. Kim · J. M. Lim · T. S. Goh
Department of Orthopaedic Surgery, Medical Research Institute, School of Medicine, Pusan National University, 1-10 Ami-Dong, Seo-Gu, Busan 602-739, Republic of Korea
e-mail: jungsublee@pusan.ac.kr

D. H. Lee
Department of Orthopaedic Surgery, Asan Medical Center, College of Medicine, University of Ulsan, Seoul, Republic of Korea

K. T. Suh
Department of Orthopaedic Surgery, Medical Research Institute, Yangsan Hospital, Pusan National University, Yangsan, Republic of Korea

Introduction

Growing interest in demonstrating the effect of treatments on the health-related quality of life of patients with idiopathic scoliosis has led to the development of tools and questionnaires [11, 18, 22]. Haher et al. [11] designed a simple, practical and disease-specific outcome instrument to assess patients with idiopathic scoliosis, and over the years, this instrument has evolved and undergone further refinement and validation [3–5, 7, 14]. The Scoliosis Research Society-22 (SRS-22) questionnaire has been shown to display good score distribution, internal consistency, reproducibility, and concurrent validity [3–5].

Given the increase in the number of multinational and multicultural research projects, the need to adapt health status measures for use in other than source languages has increased. The SRS-22 is widely used in the

English-speaking countries and has been recently translated and cross-culturally adapted for use in Italian [16], Spanish [8], Turkish [1], Japanese [13, 20, 21], Chinese [10, 15], and Greek speaking populations [2]. However, no Korean version of the SRS-22 had been previously validated. It is well established that a scale or questionnaire cannot be transposed directly from one social environment to another without being revalidated in terms of its ability to take into account culture-specific conditions [9]. Thus, the objectives of this study were to translate into the Korean language a culturally adapted version of the SRS-22 and to validate this Korean version of the SRS-22 in Korean patients.

Materials and methods

The SRS-22 questionnaire originally includes five domains. The domains and the number of questions in them are as follows: function/activity (5), pain (5), self-image/appearance (5), mental health (5), and satisfaction with management (2). The scoring scale ranges from 5 as best to 1 as worst. Each domain has a total sum score ranging from 5 to 25, except for satisfaction, which ranges from 2 to 10. Results are usually expressed as the mean (total sum of the domain divided by the number of items answered) for each domain.

The translation and adaptation processes were carried out by following published guidelines for the process of cross-cultural adaptation of self-report measures [9]. A pilot study was then performed to test whether Korean patients could understand the prefinal version correctly. The final version was obtained by expert committee discussion and tested for its validity and reliability together with the Korean version of the Short-Form 36 (SF-36) questionnaire [12].

The forward translation was completed by two native Korean translators. The two translators' versions and the original version were compared and discussed by the two translators and an orthopaedic professor, until a synthesis of the translation was reached.

The back translation was completed by two bilingual translators whose native language was English. They independently translated the synthetic version into English. Both of these translators lacked a medical background and were not informed or aware of the prior translation procedures.

All the versions of the translation, as well as the original, were put together and discussed by the four translators and an expert committee with three bilingual experts, two orthopaedic professors, and a Korean translation expert. This committee discussed the translation procedure and results until a consensus was reached on discrepancies. Accordingly, based on the synthetic forward translation, the prefinal version of SRS-22 was created.

This prefinal version of the SRS-22 questionnaire was given to 40 Korean-speaking patients who had been surgically treated for idiopathic scoliosis in other spine centers and subsequently, these patients were asked about their understanding of questionnaire items and their responses. These 40 patients included 30 females and 10 males with a mean age of 19 (range: 16–24). On the basis of their comments, the final version was developed by the expert committee (see Appendix). The majority of the 40 patients correctly understood the questionnaire. However, only 17 patients (42.5%) answered question 15 (Are you and your family experiencing financial difficulties because of your back?). In addition, 16 patients (40%) asked what question 18 (Do you go out more or less than your friends?) means. The committee decided to omit question 15 and to modify question 18 to 'Does your back condition limit your going out with friends/family?' in the final version of the Korean version of SRS-22. Only minor changes were required, and the two independent native English speakers backward translated these. The expert committee, with the participation of all translators, determined the final form of the Korean version of the SRS-22 questionnaire and a consensus was achieved.

The Korean version of the SRS-22 questionnaire and Korean version of SF-36 were mailed to 102 patients who had been surgically treated for idiopathic scoliosis in one spine center and had a minimum follow-up of 2 years. First mailing contained a consent form, a description of the study, the Korean versions of SRS-22 and SF-36, and an addressed and stamped return envelope.

Test–retest reliability was measured by comparing responses to the first and second administrations of SRS-22. Reliability was assessed with intraclass correlation coefficient [19]. Cronbach's alpha was used to evaluate internal consistency. Concurrent validity was evaluated by comparing SRS-22 domains with relevant domains in the SF-36 questionnaire where correlations were made using Pearson's correlation coefficient. All statistical analyses were performed with SPSS version 16.0.

Results

Eighty-two patients (80.4%; 70 females and 12 males) responded to the first set of questionnaires. Sixty-four (56 females and 8 males) of the first-time respondents returned their second survey. The average age of the 64 patients at time of surgery was 13.8 years (range: 10.5–17.3), and 18.3 years (range: 14.1–24.2) at the time of survey. The average elapsed time between the first and the second mailing was 4 weeks.

Table 1 Descriptive statistics on individual domain scores ($n = 82$)

Questionnaire/domain (no. of questions)	Domain mean ± SD	Floor score minimum	% With floor score	% With ceiling score
SRS-22*				
Function/activity (4)	4.5 ± 0.068	2.0	1.2	31.3
Pain (5)	4.3 ± 0.71	2.4	1.2	24.1
Self-image/appearance (5)	3.9 ± 0.69	1.8	2.4	4.8
Mental health (5)	4.2 ± 0.72	2.4	1.2	12.0
Satisfaction with management (2)	3.9 ± 0.76	2.0	2.4	8.4
SF-36†				
Physical functioning (10)	82.9 ± 23.4	30	2.4	24.1
Role-physical (4)	71.2 ± 38.3	0	9.6	49.4
Bodily pain (2)	78.1 ± 23.7	32.5	1.2	27.7
General health perceptions (5)	66.2 ± 21.3	25	1.2	2.4
Vitality (4)	71.4 ± 19.0	20	3.6	1.2
Social functioning (2)	77.8 ± 21.1	25	1.2	26.5
Role-emotional (3)	73.4 ± 36.6	0	3.6	44.6
Mental health index (5)	71.8 ± 18.9	20	1.2	1.2

SD standard deviation

* SRS-22 scale 5, best; 1, worst

† SF-36 scale 100, best; 0, worst

Table 2 Quantiles and Cronbach's α on individual domain scores ($n = 82$)

Questionnaire/domain (no. of questions)	Quantiles					Cronbach's α
	0%	25%	50%	75%	100%	
SRS-22						
Function/activity	40	88	96	100	100	0.85
Pain	48	79	88	95	100	0.83
Self-image/appearance	36	72	80	87	100	0.75
Mental health	48	75	86	96	100	0.81
Satisfaction with management	40	60	80	90	100	0.61
SF-36						
Physical functioning	30	72.5	85	95	100	0.84
Role-physical	0	50	87.5	100	100	0.83
Bodily pain	32.5	55	90	100	100	0.80
General health perceptions	25	52.5	65	85	100	0.72
Vitality	20	50	62.5	75	100	0.72
Social functioning	25	50	62.5	100	100	0.73
Role-emotional	0	58.33	91.67	100	100	0.79
Mental health index	20	55	70	85	100	0.81

Table 1 demonstrates the distribution of scores for the 5 SRS-22 and the 8 SF-36 domains. All of the domains of the SRS-22 exhibited a low level of floor effect. However, 1 domain (role-physical) of SF-36 showed a high level of floor effect. SRS-22 demonstrated a ceiling effect in function/activity and pain domains, and SF-36 showed a high ceiling effect on physical functioning, role-physical, bodily pain, social functioning, and role-emotional domains.

For comparison purposes, SRS-22 domain scores were converted to a scale from 0 to 100 to simplify comparisons with SF-36 scores. These transformed scores were analyzed by calculating the quartiles of their empirical distributions which are presented, along with the quartiles of the SF-36 domains, in Table 2. Weak spreads in the score distributions of SRS-22 function/activity and SF-36 role-physical, bodily pain, social functional and role-emotional domains were observed; it was observed that 25% of the patients in their domains scored 100.

Internal consistency reliability scores are shown in Table 2. The calculated Cronbach's α of the internal consistency of three domains (function/activity, pain and mental health) were very satisfactory (Cronbach's $\alpha = 0.80$–0.89) and of two domains (self-image and satisfaction) were good (Cronbach's $\alpha = 0.50$–0.79). The

Table 3 Test-retest reproducibility as determined by intraclass correlation coefficient ($n = 64$)

Questionnaire/domain (no. of questions)	ICC (95% CI)
SRS-22	
Function/activity	0.83 (0.71–0.89)
Pain	0.81 (0.70–0.87)
Self-image/appearance	0.84 (0.75–0.90)
Mental health	0.88 (0.81–0.93)
Satisfaction with management	0.87 (0.79–0.92)

internal consistencies for all domains of the SF-36 questionnaire are also presented in Table 3 and showed good to excellent reliability.

Test/retest reproducibility correlations are shown in Table 3. The ICC of every domain of the SRS-22 questionnaire was high (ICC $\geq$0.75), demonstrating excellent test/retest reproducibility.

Concurrent validity based on the comparison with SF-36 questionnaire is shown in Table 4. Correlations were found to be excellent ($r = 0.75$–1) (3 domains), good ($r = 0.50$–0.75) (9 domains), moderate ($r = 0.25$–0.50) (25 domains) and poor ($r = 0$–0.25) (3 domains). Strong correlations were observed in the SRS-22 function/activity domain with the SF-36 physical functioning domain, SRS-22 pain with SF-36 bodily pain, SRS-22 self-image/appearance with SF-36 general health, and SRS-22 mental health with SF-36 mental health. On the other hand, correlations between the SRS-22 satisfaction domain and the SF-36 domains were low. The correlation coefficient between the SRS-22 self-image/appearance domain and the SF-36 role-emotional domain was 0.20 ($P > 0.05$). In addition, correlation coefficients between the SRS-22 satisfaction with management domain and the SF-36 vitality and role-emotional domains were 0.18 and 0.19, respectively ($P > 0.05$).

Discussion

The objectives of this study were to produce a Korean version of SRS-22 by translation and adaption. The presence of ceiling effect for the domains of function/activity and pain has also been demonstrated [1, 5, 8, 10]. The high ceiling effect for function/activity is explained by the conservative Korean lifestyle as compared with the American one. The ceiling effect in the pain domain had been previously demonstrated [1, 5, 8, 10], and this might be the consequence of lack of pain in young adolescent idiopathic scoliosis patients.

The mean Cronbach's α value obtained from the Korean version of the SRS-22 questionnaire was found to be slightly lower than the mean Cronbach's α of the original study (0.79 vs. 0.86) [7]. This tendency has been previously observed in other cross-cultural adaptations of questionnaires [1, 8, 10], and thus, observed differences in mean Cronbach's α values could be due to cultural differences rather than translation problems.

In agreement with previously published results on internal consistency, the present study revealed a lower internal consistency for the assessment of satisfaction with treatment (Cronbach's $\alpha = 0.61$) [1, 3–5, 8, 10, 15]. That Cronbach's α for satisfaction is somewhat lower than the other α values is not surprising given it is based on only two items whereas the others have four or five items [17]. Type of management [5], severity of scoliosis and time between surgery and completing a questionnaire can also affect the results of internal consistency [4]. Li et al. [15] inferred that while patients were satisfied with surgical treatment, they were not inclined to accept the same management again, perhaps due to the financial/emotional burdens of costs as a determinant of the low internal consistency score (Cronbach's $\alpha = 0.65$), and cited a lower mean score for item 22 (Would you have the same management again if you had the same condition?) than for item 21 (Are you satisfied with the results of your back

Table 4 Concurrent validity of SRS-22 domains with SF-36 domains as determined by Pearson Correlation Coefficients ($n = 82$)

SF-36 domain	SRS-22 domain				
	Function/activity	Pain	Self-image/appearance	Mental health	Satisfaction
Physical functioning	0.78	0.71	0.43	0.34	0.27
Role-physical	0.70	0.72	0.41	0.47	0.29
Bodily pain	0.66	0.81	0.45	0.36	0.44
General health	0.54	0.54	0.76	0.40	0.43
Vitality	0.56	0.45	0.26	0.42	0.18*
Social functioning	0.39	0.43	0.37	0.36	0.39
Role-emotional	0.45	0.31	0.20*	0.41	0.19*
Mental health	0.41	0.36	0.51	0.61	0.29

* Not significant $P > 0.05$

management?). On the other hand, the results of these two items in Cheung et al. [10] indicated a higher mean score for item 22 (4.0) than item 21 (3.6). In the present study, we also found a higher mean score for item 22 (4.2) than item 21 (3.6). These results could indicate that patients were not completely satisfied with the results of management, but that they believed that they received the best treatment possible for their condition, although they were not completely satisfied with the cosmetic results. In Korean culture, surgical scarring importantly affects clinical outcome; generally, patients who undergo surgery will hide their surgical scars from others.

Test–retest reliability of the Korean version of the SRS-22 reached satisfactory reproducibility and the ICC of all domains of SRS-22 questionnaire was high (ICC >0.70), demonstrating very satisfactory or excellent test/retest reproducibility.

Concurrent validity results revealed satisfactory correlation coefficients when compared with SF-36, except for the satisfaction with management domain. Cheung et al. [10], Lai et al. [14] and Li et al. [15] demonstrated that there is an intrinsically poor correlation between the satisfaction with management domain of SRS-22 questionnaire and the relative domains of the SF-36, which is probably also reflected by our findings.

Field survey tests of the SRS-22 questionnaire [5], as well as the Turkish [1] and Spanish [8] cross-cultural adaptations demonstrated low Cronbach's α values when question 15 (Are you and/or your family experiencing financial difficulties because of your back?) and question 18 (Do you go out more or less than your friends?) were included in the function domain. Both Turkish and Spanish studies had predominantly adolescent patient populations and fewer adult patients. These problems with questions 15 and 18 were particularly evident in younger subjects [1, 6, 8, 10, 15]. The authors concluded that young patients found it difficult to answer questions 15 and 18. Thus, in the Turkish version, question 15 was cancelled and question 18 was modified, and subsequently, a higher internal consistency for the function domain was obtained during a second field survey [1]. The authors then refined the original English SRS-22 [6], by changing question 18 and not omitting question 15. Cronbach's α value of the function domain in this refined questionnaire was found to be more powerful for idiopathic scoliosis patients and for patients with other spinal disorders. However, question 15 was omitted from the Korean version of SRS-22, because Korean adolescent patients have limited knowledge of the financial burden imposed by scoliosis treatment in Korean culture.

Some potential limitations of this study should be considered. This study used only SF-36 for concurrent validity of SRS-22. To validate effectively all domains of SRS-22, some other measures of similar constructs that had previously been validated are needed.

To the authors' knowledge, this Korean version of the SRS-22 is the first condition specific outcome instrument for idiopathic scoliosis to be validated in a Korean population. The development and validation of multiple-language versions of existing validated questionnaires plays a key role in standardizing outcome measurements and increasing the statistical powers of clinical studies. The results of this study demonstrated that the SRS-22 was successfully translated into Korean without losing the psychometric properties of the original version. Accordingly, the Korean version of the SRS-22 appears to be a reliable and valid outcome measure for the assessment of functional status of patients with idiopathic scoliosis. Thus, we recommend that this Korean version of the SRS-22 can be utilized for future clinical studies in Korea.

Conflict of interest None of the authors has any potential conflict of interest.

References

1. Alanay A, Cil A, Berk H, Acaroglu RE, Yazici M, Akcali O, Kosay C, Genc Y, Surat A (2005) Reliability and validity of adapted Turkish Version of Scoliosis Research Society-22 (SRS-22) questionnaire. Spine (Phila Pa 1976) 30:2464–2468
2. Antonarakos P, Katranitsa L, Angelis L, Paganas A, Koen EM, Christodoulou EA, Christodoulou AG (2009) Reliability and validity of the adapted Greek version of Scoliosis Research Society-22 (SRS-22) questionnaire. Scoliosis 4:14
3. Asher M, Min Lai S, Burton D, Manna B (2003) Discrimination validity of the Scoliosis Research Society-22 patient questionnaire: relationship to idiopathic scoliosis curve pattern and curve size. Spine (Phila Pa 1976) 28:74–78
4. Asher M, Min Lai S, Burton D, Manna B (2003) Scoliosis Research Society-22 patient questionnaire: responsiveness to change associated with surgical treatment. Spine (Phila Pa 1976) 28:70–73
5. Asher M, Min Lai S, Burton D, Manna B (2003) The reliability and concurrent validity of the Scoliosis Research Society-22 patient questionnaire for idiopathic scoliosis. Spine (Phila Pa 1976) 28:63–69
6. Asher MA, Lai SM, Glattes RC, Burton DC, Alanay A, Bago J (2006) Refinement of SRS-22 health-related quality of life questionnaire function domain. Spine (Phila Pa 1976) 31:593–597
7. Asher MA, Min Lai S, Burton DC (2000) Further development and validation of the Scoliosis Research Society (SRS) outcomes instrument. Spine (Phila Pa 1976) 25:2381–2386
8. Bago J, Climent JM, Ey A, Perez-Grueso FJ, Izquierdo E (2004) The Spanish version of the SRS-22 patient questionnaire for idiopathic scoliosis: transcultural adaptation and reliability analysis. Spine (Phila Pa 1976) 29:1676–1680
9. Beaton DE, Bombardier C, Guillemin F, Ferraz MB (2000) Guidelines for the process of cross-cultural adaptation of self-report measures. Spine (Phila Pa 1976) 25:3186–3191
10. Cheung KM, Senkoylu A, Alanay A, Genc Y, Lau S, Luk KD (2007) Reliability and concurrent validity of the adapted Chinese version of Scoliosis Research Society-22 (SRS-22) questionnaire. Spine (Phila Pa 1976) 32:1141–1145

11. Haher TR, Gorup JM, Shin TM, Homel P, Merola AA, Grogan DP, Pugh L, Lowe TG, Murray M (1999) Results of the Scoliosis Research Society instrument for evaluation of surgical outcome in adolescent idiopathic scoliosis: a multicenter study of 244 patients. Spine (Phila Pa 1976) 24:1435–1440
12. Han CW, Lee EJ, Iwaya T, Kataoka H, Kohzuki M (2004) Development of the Korean version of Short-Form 36-Item Health Survey: health related QOL of healthy elderly people and elderly patients in Korea. Tohoku J Exp Med 203:189–194
13. Hashimoto H, Sase T, Arai Y, Maruyama T, Isobe K, Shouno Y (2007) Validation of a Japanese version of the Scoliosis Research Society-22 patient questionnaire among idiopathic scoliosis patients in Japan. Spine (Phila Pa 1976) 32:E141–E146
14. Lai SM, Asher M, Burton D (2006) Estimating SRS-22 quality of life measures with SF-36: application in idiopathic scoliosis. Spine (Phila Pa 1976) 31:473–478
15. Li M, Wang CF, Gu SX, He SS, Zhu XD, Zhao YC, Zhang JT (2009) Adapted simplified Chinese (Mainland) version of Scoliosis Research Society-22 questionnaire. Spine (Phila Pa 1976) 34:1321–1324
16. Monticone M, Carabalona R, Negrini S (2004) Reliability of the Scoliosis Research Society-22 patient questionnaire (Italian version) in mild adolescent vertebral deformities. Eura Medicophys 40:191–197
17. Nunnally JC, Bernstein IH (1994) Psychometric theory, 3rd edn. McGraw-Hill, New York
18. Roland M, Fairbank J (2000) The Roland-Morris disability questionnaire and the Oswestry disability questionnaire. Spine (Phila Pa 1976) 25:3115–3124
19. Shrout PE, Fleiss JL (1979) Intraclass correlations: uses in assessing rater reliability. Psychol Bull 86:420–428
20. Watanabe K, Hasegawa K, Hirano T, Uchiyama S, Endo N (2005) Use of the Scoliosis Research Society outcomes instrument to evaluate patient outcome in untreated idiopathic scoliosis patients in Japan: part I: comparison with nonscoliosis group: preliminary/limited review in a Japanese population. Spine (Phila Pa 1976) 30:1197–1201
21. Watanabe K, Hasegawa K, Hirano T, Uchiyama S, Endo N (2005) Use of the Scoliosis Research Society outcomes instrument to evaluate patient outcome in untreated idiopathic scoliosis patients in Japan: part II: relation between spinal deformity and patient outcomes. Spine (Phila Pa 1976) 30:1202–1205
22. Wiesinger GF, Nuhr M, Quittan M, Ebenbichler G, Wolfl G, Fialka-Moser V (1999) Cross-cultural adaptation of the Roland-Morris questionnaire for German-speaking patients with low back pain. Spine (Phila Pa 1976) 24:1099–1103