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Use of Both the Short Musculoskeletal Function Assessment Questionnaire and the Short Form-36 among Tibial Fracture Patients was Redundant

The SPRINT Investigators

Abstract

Objective—To compare the Short Musculoskeletal Function Assessment Dysfunction Index and the Short Form-36 Physical Component Summary scores among patients undergoing operative management of tibial fractures.

Study Design and Setting—Between July 2000 and September 2005, we enrolled 1319 skeletally mature patients with open or closed fractures of the tibial shaft that were managed with intramedullary nailing. Patients were asked to complete the Short Musculoskeletal Function Assessment and Short Form-36 at discharge and 3, 6, and 12 months post surgical fixation.

Results—Short Musculoskeletal Function Assessment Dysfunction Index and Short Form-36 Physical Component Summary scores were highly correlated at 3, 6, and 12 months post surgical fixation. The difference in mean standardized change scores for the Short Musculoskeletal Function Assessment Dysfunction Index and the Short Form-36 Physical Component Summary, from 3 to 12 months post-surgical fixation, was not statistically significant. Both the Short Musculoskeletal Function Assessment Dysfunction Index and Short Form-36 Physical Component Summary scores were able to discriminate between healed and non-healed tibial fractures at 3, 6, and 12 months post surgery.

Conclusion—In patients with tibial shaft fractures, the Short Musculoskeletal Function Assessment Dysfunction Index offered no important advantages over the Short Form-36 Physical Component Summary score. These results, along with the usefulness of the Short Form-36 for comparing populations, recommends the Short Form-36 for assessing physical function in studies of patients with tibial fractures.

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Keywords

tibia; fracture; quality of life; randomized controlled trial; short form-36; short musculoskeletal function assessment questionnaire

INTRODUCTION

The Short Musculoskeletal Function Assessment, based on the longer, 101-item Musculoskeletal Function Assessment questionnaire, is a two-part, 46-item, self-reported health-status questionnaire.¹ One part, the Dysfunction Index, is designed to detect differences in the functional status of patients who have a broad range of musculoskeletal disorders that are commonly seen in community practices. The second part, the Bothersome Index, allows patients to evaluate how bothered they are by functional problems. Both Short Musculoskeletal Function Assessment indexes are scored from 0 to 100 and higher scores indicate poorer function.

The Short Form-36 is a widely accepted, well-validated functional status measure that was developed from the Medical Outcomes Study.^{2–4} It is a self-administered, 36-item questionnaire that measures health-related quality of life in eight domains that can be aggregated into a physical and a mental summary score. Each summary score is scored separately from 0 to 100, and lower scores indicate poorer function

Evidence suggests that, in general, disease-specific instruments (such as the Short Musculoskeletal Function Assessment) are able to detect small but important change – that is, they are more responsive – than are generic measures.⁵ Generic measures (such as the Short Form-36) facilitate comparisons to other populations. These considerations provide the rationale for the common use of both the Short Musculoskeletal Function Assessment and the Short Form-36 in current orthopaedic trials.^{6,7} Use of both instruments, however, increases the burden on both patients and researchers and may therefore adversely impact on trial feasibility. This study was designed to assess what is gained by adding the Short Musculoskeletal Function Assessment to the Short Form-36 in clinical trials of patients with tibial fractures.

MATERIALS & METHODS

From July 2000 to September 2005 we enrolled 1319 patients with open (Gustilo Type I–IIIb) and closed (Tscherne Type 0–3) tibial shaft fractures amenable to operative fixation with an intramedullary nail in a multi-centre, randomized controlled trial, the eponym for which is SPRINT (Study to Prospectively evaluate Reamed Intramedullary Nails in Tibial fractures). Each institution's ethics review board approved the study, which was registered at *Clinicaltrial.gov* (Identifier: NCT00038129); readers can obtain details of the study design elsewhere.⁸

At discharge from hospital, patients rated their pre-injury status using the Short Musculoskeletal Function Assessment and Short Form-36. We have previously shown that patients undergoing lower limb orthopaedic surgery recall their preoperative quality of life, function, and general health at 2 weeks postoperative with sufficiently high accuracy to warrant substituting prospectively collected baseline data with recalled ratings.⁹ Patients completed the Short Musculoskeletal Function Assessment and Short Form-36 again at 3, 6, and 12 months post-surgery. Patients completed all questionnaires under the supervision of personnel trained to facilitate instrument completion without influencing responses. The role of supervising personnel was limited to reviewing respondents' questionnaires after completion

to confirm that each item was answered, and to draw attention to any contradictory responses and to provide respondents with the opportunity to make changes if they saw fit. Patients' attending surgeons assessed fracture healing at each follow-up time on the basis of lateral and anteroposterior radiographs of patients' fractures.

Statistical Analysis

Our analyses, at each time point, were restricted to only those patients who provided completed Short Musculoskeletal Function Assessment and Short Form-36 questionnaires. When follow-up time differed from that specified in the protocol, we used follow-up to the scheduled time point closest to the actual follow-up. If two actual follow-up times were nearest to a single scheduled time-point, we used data from the actual follow-up closest to the scheduled time. We evaluated differences in patient characteristics between time-points with a t-test for normally distributed data and a chi-squared test for proportional data; we set our level of statistical significance at $p < 0.05$. At each time point we calculated the Pearson correlation coefficient and associated 95% confidence interval between Short Musculoskeletal Function Assessment Dysfunction Index and SF-36 Physical Component Summary scores for all respondents. We explored the ability of the Short Musculoskeletal Function Assessment Dysfunction Index and Short Form-36 Physical Component Summary scores to discriminate between patients who had, or had not, healed radiographically at each follow-up point with a paired t-test.

We calculated instrument responsiveness through a standardized response mean, the mean score change divided by the standard deviation of the score change.¹⁰ We compared the difference in standardized change scores for the Short Musculoskeletal Function Assessment Dysfunction Index and the Short Form-36 Physical Component Summary from 3 to 12 months with a paired t-test. We also tested whether the differences in standardized response means between the Short Form-36 Physical Component Summary and the Short Musculoskeletal Function Assessment Dysfunction Index were significant using the modified jack knife procedure.^{11,12} In this analysis, each patient's standardized response mean was calculated as their individual change in score divided by the standard deviation of change in the whole cohort.

We centered the standardized response mean value for each instrument by subtracting the mean standardized response mean score from each individual standardized response mean score. Using linear regression, we predicted the differences in standardized response means between two different scales by including the centered standardized response mean value of one of the two instruments of interest as a predictor in the model; the dependant variable assures that either choice of instrument as a predictor will yield the same intercept. A significant intercept coefficient then represents a significant difference between standardized response means of the two instruments.

We explored the proportion of patients who achieved the minimally important difference in the Short Musculoskeletal Function Assessment Dysfunction Index and Short Form-36 Physical Component Summary scores between each follow-up time with a McNemar test for 2 sets of observations on the same sample of patients; we set our level of significance at $p < 0.05$.

We reviewed test scores at 3 months post-surgery to explore for a floor effect (scores reflecting the lowest level of functioning) in either Short Musculoskeletal Function Assessment Dysfunction Index or Short Form-36 Physical Component Summary scores. To explore for possible ceiling effects, scores reflecting optimal functioning, we examined patients' estimated pre-injury Short Musculoskeletal Function Assessment Dysfunction Index and Short Form-36 Physical Component Summary scores, provided at discharge, and the scores of all patients whose tibial fracture was declared healed at 3, 6, and 12 months follow-up. An instrument was

considered to have floor/ceiling effects if >10% of scores were at the lowest or highest level of functioning.

Tibial fractures are often not isolated injuries and generic health related quality of life measures, such as the Short Form-36 Physical Component Summary, are influenced by co-morbidity. Thus, presence of co-morbidity may attenuate the signal of the tibial fracture on the Short Form-36. To explore this potential measurement issue we repeated all analyses of Short Form-36 Physical Component Summary and Short Musculoskeletal Function Assessment Dysfunction Index scores among patients with isolated tibial fractures (only one tibia fractured and no additional fractures or injuries) and patients with multi-trauma. All comparisons were 2-tailed and a p-value of < 0.05 was considered statistically significant.

RESULTS

Table 1 presents demographic data for our population. Response rates were 83% at discharge (n=1089), 69% at 3 months (n=906), 60% at 6 months (n=787), and 53% at 12 months post-surgery (n=700). There were no significant differences in patient characteristics between time-points. At all time points Short Musculoskeletal Function Assessment Dysfunction Index and SF-36 Physical Component Summary scores were strongly and significantly inversely correlated (Table 2). Both the Short Musculoskeletal Function Assessment Dysfunction Index and the Short Form-36 Physical Component Summary mean scores demonstrated statistically significant differences between patients with healed versus unhealed tibial fractures at 3, 6, and 12 months post-surgical fixation (Table 3).

There are no existing guidelines for the Short Musculoskeletal Function Assessment score difference that constitutes a minimally important difference. A 3 to 5 point change in score on a 0 to 100 scale is often cited as a meaningful threshold in evaluating patient changes in Short Form-36 scores, based on the work by Stewart and colleagues.¹³ More recent work by other authors has suggested that the smallest important difference may be larger than 3 to 5 points,^{14, 15} and a recent systematic review found that the threshold of discrimination for changes in the Short Form-36 is approximately half a standard deviation¹⁶. Applying this criterion to our data, the minimally important difference was approximately 7 points for the Short Musculoskeletal Function Assessment Dysfunction Index score and approximately 5 points for the Short Form-36 Physical Component Summary score, and the mean change in both instruments exceeded this importance threshold.

The proportion of patients who achieved a minimally important difference was significantly higher for Short Musculoskeletal Function Assessment Dysfunction Index scores from 3 to 6 months post-surgery than for Short Form-36 Physical Component Summary scores (Table 4). Differences in proportions from 6 to 12 months were not significant except when restricted to patients with isolated fractures, in which case Short Form-36 Physical Component Summary scores yielded a higher proportion of patients meeting the minimally important difference for improvement.

The modified jack knife approach (linear regression) found that differences in standardized response means of the Short Form-36 Physical Component Summary and Short Musculoskeletal Function Assessment Dysfunction Index from 3 to 12 months post-surgery were not significant (p=0.12). Changes in both instruments showed statistically significant improvement in function from 3 months to 12 months, and the standardized response means were very similar; any differences could be explained by chance (Table 2). With the exception of the Short Musculoskeletal Function Assessment Dysfunction Index which exhibited a ceiling effect (16.9% of respondents provided a score of zero) when patients were asked to rate their pre-injury status, we found no evidence of floor or ceiling effects for either Short

Musculoskeletal Function Assessment or Short Form-36 Physical Component Summary scores in our population. Our results were similar when repeated on subpopulations of patients with isolated tibial fractures (Tale 5– Tale 7) and multi-trauma (data not shown).

DISCUSSION

We found that, in patients with tibial fractures, the Short Musculoskeletal Function Assessment Dysfunction Index and Short Form-36 Physical Component Summary scores are highly correlated, and demonstrate similar responsiveness and discriminative validity. We found no evidence of floor effects; however, a ceiling effect of the Short Musculoskeletal Function Assessment Dysfunction Index was found when patients estimated their pre-injury level of function. The presence of floor/ceiling effects would suggest limitations in an instrument's ability to distinguish between patients with different levels of function due to clustering of scores at extremes. Ceiling effects also decrease an instrument's ability to assess the patients' improvement following injury due to clustering of patient's scores at maximal recovery.¹⁷

The Short Musculoskeletal Function Assessment Dysfunction Index classifies patients as having achieved the minimally important difference earlier in the recovery process following surgical fixation of tibial fractures than the Short Form-36 Physical Component Summary score, and this difference appears to be greatest among patients presenting with multi-trauma. The significance of this earlier labelling is uncertain. No studies have empirically addressed the minimally important difference associated with the Short Musculoskeletal Function Assessment and we applied a somewhat arbitrary value of ½ the standard deviation as the minimally important difference for both instruments. Perhaps even more importantly, if one were using the instruments in randomized trials, a more pertinent quantity would be the difference in the proportion of patients who exceed the minimally important difference, and in this situation the particular threshold one uses for the minimally important difference makes little difference.¹⁸

The strengths of our study include a large sample size of patients presenting with similar injuries. Our study does have some limitations. After a patient's fracture was declared healed by their attending surgeon they were no longer required to attend fracture clinic, which adversely impacted follow-up rates for quality of life instruments. Hence, our follow-up rates for completed Short Musculoskeletal Function Assessment and Short Form-36 questionnaires dropped from 83% at discharge to 53% at 12 months post-surgery.

To minimize respondent burden, we assessed pre-injury status, but not current status, with the Short Musculoskeletal Function Assessment and Short Form-36 questionnaires at discharge. This may have limited our ability to detect floor effects on instruments. Further, it remains possible that we would have found significant differences between standardized change scores of the Short Form-36 Physical Component Summary and the Short Musculoskeletal Function Assessment Dysfunction Index had we used discharge, rather than 3 months post-discharge, scores as our baseline.

Our use of estimates of pre-operative health status made post-operatively was based on the results of a previous study, conducted on a large population of patients undergoing elective arthroscopic knee surgery, that provided compelling evidence that patients can accurately recall their pre-operative state, 2 weeks post-operatively (intra-class correlation coefficient between pre-and post-operative assessments of pre-operative Short Form-36 Physical Component Summary scores was 0.81; 95% confidence interval = 0.75 to 0.86).⁸ We could not make the same assessment in the current study because we did not have pre-operative measures of health status. Our finding of a lower correlation between Short Form-36 Physical Component Summary and Short Musculoskeletal Function Assessment Dysfunction Index scores for

estimates of pre-injury status in comparison to post-injury assessments (Table 2 & 6) was likely affected by the ceiling effect present with the Short Musculoskeletal Function Assessment. Alternative explanations may include that that our patients were less able to recall their pre-operative health state than patients undergoing elective arthroscopic knee surgery, or that patient's pre-injury recall may be more reliable with the Short Form-36 Physical Component Summary (the instrument used in the previous study) than the Short Musculoskeletal Function Assessment Dysfunction Index.

Another limitation of our study is the uncertain significance of radiological healing of tibial fractures. Differences between mean instrument scores of radiographically healed and unhealed patients were statistically significant at all 3 time points we assessed, but their magnitude was relative small at 3 and 6-months post-discharge (Table 3 and Table 7). This suggests that radiographic healing of tibial fractures may have limitations as a surrogate for functional recovery.

The generalizability of our results to other populations is uncertain. For instance, a previous investigation found that the 101-item Musculoskeletal Function Assessment questionnaire had superior responsiveness and less ceiling and floor effects than the Short Form-36.¹⁹ The 444 patients who participated in this study were a highly diverse orthopaedic population, including 121 with upper extremity injuries.¹⁹ The Short Form-36 has minimal capacity to detect upper-extremity deficits as it has few items that specifically address upper-extremity function and this measure would, therefore, be more likely to exhibit ceiling effects.² The existence of the arm/hand subscale of the Short Musculoskeletal Function Assessment is one potential advantage over the Short Form-36, and for that population the Short Musculoskeletal Function Assessment may have important advantages over the Short Form-36.

Kirschner et al. found that the Short Musculoskeletal Function Assessment demonstrated larger effect sizes than the Short Form-36 in 63 patients with primary osteoarthritis undergoing total knee arthroplasty.²⁰ However, their analysis was inappropriate as they compared the effect size of the Short Musculoskeletal Function Assessment Dysfunction Index to all 8 domains of the Short Form-36, instead of comparing the Short Musculoskeletal Function Assessment Dysfunction Index to the Short Form-36 Physical Component Summary score. Obremskey and colleagues administered both the Short Musculoskeletal Function Assessment and the Short Form-36 on a single occasion to a group of 127 patients with isolated ankle fractures, managed operatively, an average of 27 months after their injury.²¹ They found equivalent measurement properties with the exception of floor effects in two of eight Short Form-36 domains. However, the Short Form-36 is typically reported according to Physical Component Summary or Mental Component Summary scores, and not as 8 domains.

Our findings also suggest that the additional information gained by administering both the Short Musculoskeletal Function Assessment Dysfunction Index and the Short Form-36 Physical Component Summary is insufficient to justify the respondent burden in trials of tibial fracture patients. Given the far more extensive use of the Short Form-36, more extensive validation, and ability to compare to other populations, we feel that the Short Form-36 Physical Component Summary score's similar performance to the Short Musculoskeletal Function Assessment Dysfunction Index in patients with tibial fractures dictates the Short Form-36 as the instrument of choice for assessing physical function in these patients. Generalizing these results beyond this specific population is currently not warranted, and will require similar specific comparisons.

What is New?

- The Short Musculoskeletal Function Assessment Dysfunction Index and the Short Form-36 Physical Component Summary score were highly correlated among tibial fracture patients
- Both the Short Musculoskeletal Function Assessment Dysfunction Index and the Short Form-36 Physical Component Summary score were able to discriminate between radiographically healed and non-healed tibial fractures
- Orthopaedic trialists often report functional recovery with both the Short Musculoskeletal Function Assessment Dysfunction Index and the Short Form-36 Physical Component Summary score
- In patients with tibial shaft fractures, the Short Musculoskeletal Function Assessment Dysfunction Index offered no important advantages over the Short Form-36 Physical Component Summary score
- Given its more extensive validation, and ability to compare to other populations, the Short Form-36 should be the instrument of choice to assess functional recovery in tibial fracture patients.

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Table 1

Demographic characteristics of all patients*

	Discharge	3 months Post-Surgery	6 months Post-Surgery	12 months Post-Surgery
n	1089	906	787	700
Age at discharge, mean (SD)	39.1 (15.5)	39.0 (15.5)	39.4 (15.4)	40.0 (15.4)
Gender, n (%)				
Male	820 (75.3%)	667 (73.6%)	583 (74.1%)	515 (73.6%)
Female	269 (24.7%)	239 (26.4%)	204 (25.9%)	185 (26.4%)
Open Fractures, n (%)	342 (31.3%)	270 (29.6%)	234 (29.5%)	214 (30.4%)
Closed Fractures, n (%)	752 (68.7%)	643 (70.4%)	559 (70.5%)	490 (69.6%)
Gustilo Grade for Open Fractures				
I	90 (26.3%)	67 (24.8%)	55 (23.5%)	53 (24.8%)
II	134 (39.2%)	113 (41.9%)	99 (42.3%)	82 (38.3%)
IIIA	91 (26.6%)	68 (25.2%)	57 (24.4%)	55 (25.7%)
IIIB	27 (7.9%)	22 (8.1%)	23 (9.8%)	24 (11.2%)
Tscherne Grade for Closed Fractures				
0	235 (31.3%)	199 (30.9%)	171 (30.6%)	159 (32.4%)
1	378 (50.3%)	323 (50.2%)	291 (52.0%)	249 (50.8%)
2	126 (16.8%)	108 (16.8%)	87 (15.6%)	73 (14.9%)
3	13 (1.7%)	13 (2.0%)	10 (1.8%)	9 (1.8%)
Isolated Fractures, n (%)	739 (67.9%)	615 (67.9%)	526 (66.8%)	465 (66.4%)
Multi-trauma, n (%)	350 (32.1%)	291 (32.1%)	261 (33.2%)	235 (33.6%)

* Some multi-trauma patients presented with bilateral tibial fractures, resulting in the total number of open and closed fractures being greater than the total number of patients.

Short Form-36 Physical Component Summary and Short Musculoskeletal Function Assessment Dysfunction Index Scores at Follow-up Times

Table 2

Measurement	n	SF-36 PCS		SNFSA Dysfunction Index		Correlation ¹ (95% CI)
		Score	SD	Mean	SD	
Retrospective assessment prior to injury (asked at discharge)	1089	53.3	8.6	7.7	13.1	-0.55 (-0.59, -0.51)
3 months post-surgery	906	54.0	9.3	31.6	17.5	-0.71 (-0.74, -0.68)
6 months post-surgery	787	59.1	10.7	22.9	17.7	-0.80 (-0.82, -0.77)
12 months post-surgery	700	43.2	11.3	17.5	17.0	-0.81 (-0.83, -0.78)
Change from 3 to 12 months post-surgery	606	9.5*	10.0	-14.0*	14.0	
Standardized Response Mean (SRM) ²	606	0.95		1.00		

* p-value <0.0001 for the change score for both instruments

¹ All correlations are significant at p<0.0001

² A paired t-test for the difference between the SRMs for the two instruments is non-significant at p=0.16

Key

SF-36 PCS: Short Form-36 Physical Component Summary

SNFSA: Short Musculoskeletal Function Assessment

SD: Standard Deviation

n: sample size

95% CI: 95% Confidence Interval

Short Form-36 Physical Component Summary and Short Musculoskeletal Function Assessment Dysfunction Index Scores by Patient's Healing Status

Table 3

Follow Up Time	Fracture Status	n	SF-36 PCS Score*		SMFA Dysfunction Index*	
			Mean	SD	Mean	SD
3 months	Healed	144	37.1	9.2	25.4	16.5
	Not Healed	57	33.5	9.2	32.9	17.5
6 months	Healed	348	41.6	10.5	19.0	15.7
	Not Healed	309	36.9	10.6	26.5	19.3
12 months	Healed	533	44.6	10.7	15.6	15.8
	Not Healed	79	35.1	11.4	29.9	20.1

* All comparisons of mean scores for healed versus non-healed were statistically significant at $p \leq 0.001$

Key

SF-36 PCS: Short Form-36 Physical Component Summary

SMFA: Short Musculoskeletal Function Assessment

n: sample size

SD: Standard Deviation

Table 4

Proportion of Short Form-36 Physical Component Summary and Short Musculoskeletal Function Assessment Dysfunction Index Scores meeting the Minimally Important Difference¹

Instrument	All Fractures		Multi-Trauma		Isolated Fractures	
	SF-36 PCS	SMFA DI	SF-36 PCS	SMFA DI	SF-36 PCS	SMFA DI
Change from 3 to 6 months post-surgery comparison	53.9% (349/697) [†] p<0.01	58.5% (408/697) [†] p<0.01	39.0% (87/223) [†] p<0.01	54.3% (121/223) [†] p<0.05	55.3% (252/456) [†] p<0.05	60.3% (275/456) [†] p<0.05
Change from 6 to 12 months post-surgery comparison	43.1% (251/582) [†] p=0.08	39.2% (228/582) [†] p=0.08	46.6% (88/189) [†] p=0.79	45.0% (85/189) [†] p=0.04	42.0% (158/376) [†] p=0.04	36.4% (137/376) [†] p=0.04
Change from 3 to 12 months post-surgery comparison	65.8% (399/606) [†] p<0.01	71.6% (434/606) [†] p<0.01	63.3% (124/196) [†] p=0.03	71.4% (140/196) [†] p=0.03	67.1% (275/410) [†] p=0.06	71.7% (294/410) [†] p=0.06

¹The minimally important difference was a change of 5 points or more for SF-36 PCS scores, and a change of 7 points or more for the SMFA DI

[†]Differences between questionnaires are significant at p<0.05

Key

SF-36 PCS: Short Form-36 Physical Component Summary

SMFA DI: Short Musculoskeletal Function Assessment Dysfunction Index

Table 5

Demographic Characteristics of Patients with Isolated Tibial Fractures

	Discharge	3 months Post-Surgery	6 months Post-Surgery	12 months Post-Surgery
n	739	615	526	465
Age at discharge, mean (SD)	39.5 (15.2)	39.6 (15.3)	40.3 (15.4)	40.9 (15.2)
Gender, n (%)				
Male	566 (76.6%)	461 (75.0%)	394 (74.9%)	342 (73.5%)
Female	173 (23.4%)	154 (25.0%)	132 (25.1%)	123 (26.5%)
Open Fractures, n (%)	216 (29.2%)	173 (28.1%)	148 (28.1%)	130 (28.0%)
Closed Fractures, n (%)	523 (70.8%)	442 (71.9%)	378 (71.9%)	335 (72.0%)
Gustilo Grade for Open Fractures				
I	65 (30.1%)	46 (26.6%)	38 (25.7%)	36 (27.7%)
II	79 (36.6%)	70 (40.5%)	60 (40.5%)	46 (35.4%)
IIIA	55 (25.5%)	44 (25.4%)	36 (24.3%)	33 (25.4%)
IIIB	17 (7.9%)	13 (7.5%)	14 (9.5%)	15 (11.5%)
Tscherne Grade for Closed Fractures				
0	184 (35.2%)	149 (33.7%)	127 (33.6%)	124 (37.0%)
1	257 (49.1%)	222 (50.2%)	197 (52.1%)	162 (48.4%)
2	71 (13.6%)	60 (13.6%)	46 (12.2%)	42 (12.5%)
3	11 (2.1%)	11 (2.5%)	8 (2.1%)	7 (2.1%)

Short Form-36 Physical Component Summary and Short Musculoskeletal Function Assessment Dysfunction Index Scores at Follow-up Times, for Patients with Isolated Tibial Fractures

Table 6

Measurement	n	SF-36 PCS Score		SMFA Dysfunction Index		Correlation ¹ (95% CI)
		Mean	SD	Mean	SD	
Retrospective assessment prior to injury (asked at discharge)	739	53.2	8.8	8.0	12.9	-0.59 (-0.63, -0.54)
3 months post-surgery	615	35.0	9.3	28.7	15.7	-0.72 (-0.75, -0.68)
6 months post-surgery	526	40.8	10.5	19.8	16.2	-0.80 (-0.83, -0.76)
12 months post-surgery	465	44.8	10.7	14.5	14.7	-0.80 (-0.83, -0.77)
Change from 3 to 12 months post-surgery	410	10.1 [*]	9.8	-13.9 [*]	12.7	
Standardized Response Mean (SRM) ²	410	1.0		1.1		

* p-value <0.0001 for the change score for both instruments

¹ All correlations are significant at p<0.0001

² A paired t-test for the difference between the SRMs for the two instruments is non-significant at p=0.10

Key

SF-36 PCS: Short Form-36 Physical Component Summary

SMFA: Short Musculoskeletal Function Assessment

SD: Standard Deviation

n: sample size

95% CI: 95% Confidence Interval

Short Form-36 Physical Component Summary and Short Musculoskeletal Function Assessment Dysfunction Index Scores by Patient's Healing Status, for Patients with Isolated Tibial Fractures

Table 7

Follow Up Time	Fracture Status	n	SF-36 PCS Score*		SMFA Dysfunction Index*	
			Mean	SD	Mean	SD
3 months	Healed	111	38.3	9.1	22.7	13.8
post-surgery	Not Healed	392	34.4	9.2	29.9	16.0
6 months	Healed	253	43.0	10.1	16.7	14.3
post-surgery	Not Healed	198	38.8	10.5	22.9	18.1
12 months	Healed	372	45.8	10.2	13.4	14.1
post-surgery	Not Healed	44	37.6	12.1	22.9	17.4

* All comparisons of mean scores for healed versus non-healed were statistically significant at p≤0.001

Key

SF-36 PCS: Short Form-36 Physical Component Summary

SMFA: Short Musculoskeletal Function Assessment

n: sample size

SD: Standard Deviation