

Rate of Return of Functional Outcome After Open Reduction and Internal Fixation of Unstable Ankle Fractures

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Abstract

In the prospective cohort study reported here, we used the Short Musculoskeletal Function Assessment (SMFA) questionnaire to assess rate of return of functional outcome after open reduction and internal fixation of unstable ankle fractures (Orthopaedic Trauma Association/ Arbeitsgemeinschaft für Osteosynthesefragen [OTA/AO] 44B and 44C) at a level II trauma center over the course of 1 year.

The entire group of 69 consecutive adults improved significantly ($P < .01$) on the SMFA Emotional Status and Dysfunction scales from 2 to 4 months and on the Mobility and Daily Activities scales from 2 to 4 months and from 4 to 6 months. There were no significant changes on the Arm/Hand Function and Bother scales. There was a significant effect of age on Mobility, Daily Activities, and Dysfunction, with older patients (≥ 50 years) obtaining higher (worse) scores. There was no significant effect on patient sex on any of the scales. Patients with 44C fractures (vs 44B fractures) had significantly ($P = .05$) higher mean Bother scores at 6 months. There were no significant differences arising from presence or absence of a fracture of the medial malleolus.

Our SMFA data show that older patients (≥ 50 years) and patients with 44C fractures had slower return to maximal function and higher Bother scores at 6 months. All groups reached a relatively stable functional outcome by 6 months after injury, but their mobility did not return to population norms over the same period.

Fractures about the ankle are among the most common injuries encountered by orthopedic surgeons.¹ Outcomes with open reduction and internal fixation (ORIF) for most ankle fracture patterns usually depend as much on adequacy of reduction as on sever-

ity of initial injury.²⁻⁵ Evidence to support maximum return of function in patients with ankle fractures within the first postoperative year has been published. However, little has been reported regarding the interval rate of functional return after these fractures.

We designed a prospective study to determine the interval rate of functional return as well as time to a relative maximum functional outcome after ORIF of unstable ankle fractures using the Short Musculoskeletal Function Assessment (SMFA). It has been shown that patients make significant improvements in their outcome scores 1 to 2 years after typical release from clinical follow-up.^{5,6} However, more specific information concerning the monthly improvement of patients within the first year is not available. In this prospective study following patients over set periods within the first year after injury, our goal was to determine interval improvements in function on a monthly basis in order to more accurately provide patients with prognostic information and to give surgeons a reference for a patient's maximal recovery.

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MATERIALS AND METHODS

After obtaining approval from the investigational review board at our institution, we recruited 69 consecutive patients who underwent ORIF of unstable ankle fractures. Fractures included in the study were OTA/AO types 44B and 44C. Fractures were surgically repaired by multiple orthopedic surgeons practicing at a level II community trauma center between January 2000 and December 2000. Patients were asked to complete an SMFA questionnaire monthly for 1 year after their surgery. An orthopedic research nurse gathered the data prospectively either in clinic, by mail, or by telephone.

Only 5 patients completed all 12 monthly SMFA evaluations, which made it impossible to analyze the data from the entire group at monthly intervals as originally planned. Of the 69 patients included in the study, 55 (80%) were available for follow-up but missed 1 or more evalua-

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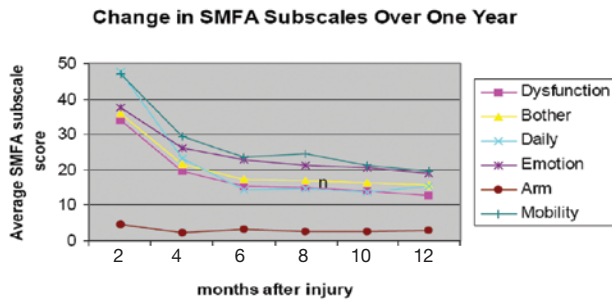


Figure 1. Mean scale scores for the entire cohort at every-other-month intervals show the plateau in improvement between 4 and 6 months.

tions. Forty-nine patients (71%) completed a minimum of 6 evaluations and missed no more than 1 consecutive evaluation, thus providing 49 patients for follow-up at bimonthly intervals.

Of the 49 patients (12 men, 37 women) included in the statistical analysis, 22 were 49 or younger (age range, 23-49 years), and 27 were 50 or older (age range, 50-78 years). Thirty-six fractures were type 44B (seven 44B1, sixteen 44B2, thirteen 44B3), and 13 fractures were type 44C (three 44C1, seven 44C2, three 44C3). Thirty-six patients had a fracture of the medial malleolus; 13 did not. Twelve patients were laborers, 23 were nonlaborers, 9 were retired, and 4 were unemployed; the work status for 1 was unknown.

The SMFA is a 2-part, 46-item self-report questionnaire that takes 8 to 10 minutes to complete. The instrument is divided into Dysfunction and Bother scales. The Dysfunction scale has 34 items assessing patients' perceptions of their functional performance in 4 categories: Daily Activities, Emotional Status, Arm/Hand Function, and Mobility. The Bother scale has 12 items assessing how much patients are bothered by their problems in areas such as Recreation and Leisure, Sleep and Rest, Work, and Family. Each question is answered on a 5-point Likert scale ranging from 1 (*good function or not bothered at all*) to 5 (*poor function or extremely bothered*). Dysfunction and Bother scores are calculated on a 0-to-100 scale, with higher scores indicating poorer function.

The SMFA was designed to detect differences in function among patients with a broad range of musculoskeletal disorders and to allow patients to evaluate how bothered they are by those functional problems. The SMFA has been shown to be a valid and reliable tool for comparison of a patient over time and against the general population.⁷ It has also correlated well with other general health measures of function, such as the Medical Outcomes Survey Short Form (SF-36), in return of function after ankle fractures.⁸

SMFA scale scores were analyzed by routine descriptive statistics and repeated-measures of analysis of variance (ANOVA). Significance was set at $P \leq .05$. Analyses were made on the entire group and—when the subjects were grouped by age (≤ 49 years vs ≥ 50 years)—also by sex, fracture type (44B vs 44C), and presence or absence of

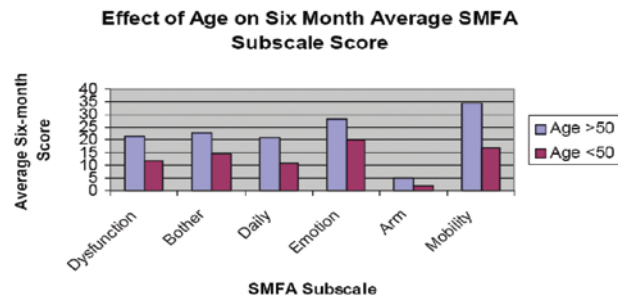


Figure 2. Comparison of age groups (≤ 49 years vs ≥ 50 years) shows higher mean scale scores for older patients 6 months after injury. P s = .016, .16, .026, .13, .12, and .0028, respectively.

a medial malleolus fracture. These factors were analyzed because they were previously associated with poor outcomes in ankle fractures. Additional analyses (for time to return to work, incidence of complications, frequency of hardware removal, and level of function attained) were performed for comparisons with other published data for validity purposes.

RESULTS

Rate of Return

Analysis of SMFA scores with regard to rate of functional return for the entire group showed significant improvement with the passage of time. With respect to each time interval, the most drastic improvement was made during the first 2 postoperative months. Between 2 and 4 months, patients improved significantly on all Dysfunction scales (Mobility, Arm/Hand Function, Emotional Status, Daily Activities), but there was no significant difference in the Bother scale. Between 4 and 6 months, a significant improvement was observed in the Dysfunction scales of Mobility and Emotional Status. Improvements were also found on the Bother scale. Only Emotional Status continued to show significant improvements at 6, 8, 10, and 12 months (Figure 1). There was no significant difference in rate of recovery with regard to fracture classification or in presence of a medial malleolus fracture. All patients reached a plateau of improvement between 4 and 6 months after surgery.

Level of Return

Mean level of improvement at the plateau point for all SMFA scales (mean value at 6 months) was used to compare the entire group with published population norms⁹ and to make comparisons between groups within the cohort. A single-factor ANOVA for the scale mean scores at 6 months for younger patients (≤ 49 years) and older patients (≥ 50 years) showed significant differences in the Dysfunction ($P = .016$), Daily Activities ($P = .026$), and Mobility ($P = .0028$) scales, with younger patients having better (lower) scores. However, there was no significant difference between the age groups on the Bother, Emotional Status, or Arm/Hand Function scales (P s = .16, .13, and .12, respectively) (Figure 2). There was also no statistically

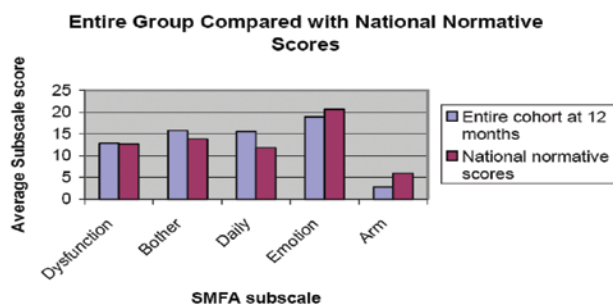


Figure 3. Mean scale scores 12 months after injury show that, by this time, all patients had approached but not yet reached the national normal level.

significant difference between men's and women's scores at 6 months ($P = .37-.92$), but mean women's scores on all scales were slightly higher (worse).

At 6 months, mean Bother scores were significantly ($P = .05$) higher for 44C fractures than for 44B fractures. In the other 5 scales, the difference was not significant ($P = .11-.32$), though 44C fractures did have a slightly higher (worse) mean score on all scales. Comparison of 6-month mean SMFA scores between patients with and without a fracture of the medial malleolus did not show a statistically significant difference in any scale ($P = .22-.88$), with patients having a fracture of the medial malleolus scoring slightly lower (better) on all scales except Mobility.

Comparison With Normal Scores

Mean Mobility scores were significantly higher ($P < .05$) than national normative scores 6 months after injury for the entire group, for 44B fractures, for 44C fractures, and for a fracture of the medial malleolus. The difference between the normal scores and the scores for the entire group, the 44B fractures, the 44C fractures, and patients with or without a fracture of the medial malleolus was not significantly different for the Daily Activities, Emotional Status, Arm/Hand Function, or Bother scale (Figure 3).

Return to Work

Analysis of time to return to full-time work revealed no significant differences between 44B and 44C fractures, presence or absence of a fracture of the medial malleolus, or gender, but there was a significant difference ($P = .04$) between younger patients (≤ 49 years) returning to work (mean, 52 days; range, 1-228 days) and older patients (≥ 50 years) returning to work (mean, 104 days; range, 20-321 days). Hardware removal was performed in 7 patients (14%): 1 case (2%) for pain and 6 cases (12%) for syndesmosis screw removal. There were 3 complications: 1 minor, 2 major. The minor complication, a sensory neuropathy along the sural distribution, resolved spontaneously. One major complication was a delayed union in a 69-year-old patient with diabetes. His hardware failed after beginning weight-bearing at 8 weeks and required a revision operation before ultimately healing in 5° of varus 6 months later.

The other major complication, which occurred in a healthy 27-year-old man, was loss of reduction of the syndesmosis (detected on initial postoperative clinic follow-up). This patient, who also required a second operation to revise the syndesmosis, healed uneventfully. Four other complications (2 superficial infections, 1 deep venous thrombosis, 1 deep infection) occurred in patients who did not complete enough SMFA evaluations to be included in the statistical analysis (these patients were not lost to follow-up and were followed until their fractures healed).

The 20 patients excluded from statistical comparison because of deficient SMFA evaluations were younger ($P \leq .05$) and more often male ($P = .02$). There was no statistically significant difference between the group excluded from analysis and the 49-patient cohort in terms of fracture pattern (44B vs 44C), presence or absence of a fracture of the medial malleolus, or frequency of hardware removal or complications.

DISCUSSION

Belcher and colleagues⁵ reviewed 40 patients who had ORIF of closed, uncomplicated ankle fractures and found that there was no significant improvement in Olerud and Molander¹⁰ ankle scores between 8 to 10 months and 11 to 24 months. Although our study covered only 1 year, our data appear to show a trend toward a similar course: no statistically significant improvement in 5 of 6 SMFA scale scores after 6 months. Continued improvement on Emotional Status throughout the 1-year study may show that it takes patients longer to adapt to the injured state and will require longer-term follow-up to determine when the scores in that scale approach a baseline. Van der Sluis and colleagues⁸ reported on the prolonged psychological effects of ankle fractures.

Obremskey and colleagues⁶ studied 20 patients 4.4 and 20 months after ORIF for unstable ankle fractures and found significant improvements in all SF-36 domains except General Health during the time interval. Our present data show that, over 2-month intervals, SMFA outcomes initially improve and then plateau 6 months after surgery. There was a continued trend toward lower scores compared with US normal data, but at 6 months only the Mobility scale showed statistically significant improvements.

Pagliaro and colleagues,¹¹ reviewing the results of 23 patients who were age 65 or older and had ORIF for Weber type B (OTA/AO 44B) ankle fractures, found that the union rate was 100% and that all complications were related to comorbidities. The authors concluded that, in spite of its higher complication rate, ORIF in the elderly is as efficacious and safe as it is in younger patients. In our study, 7 of the 22 patients who were age 50 or older were 65 or older. Our results with older patients showed that their potential for improvement may be less, as these patients had higher (worse) mean scale scores at 6 months in all categories; however, their risk for complications was not increased. Hoiness and colleagues¹² reviewed 88 patients 3.7 years after surgery for ankle fractures and had similar findings, in that patients under age 50 had significantly

($P = .025$) better subjective functional scores. Our data confirm these findings, as our patients under age 50 had significantly improved 6-month functional scores on the Dysfunction, Daily Activities, and Mobility scales than our patients age 50 or older. Older patients also took twice as long as younger patients to return to work (104 and 52 days, respectively).

Our results in comparing the 44B and 44C fracture patterns showed no significant differences between SMFA scores in either time to recovery or in mean level of recovery reached, except for the Bother scale at 6 months. We anticipated that rehabilitation of 44C fractures would be longer because of the severe ligamentous injury in this fracture pattern. Lindsjö¹³ reported on 306 ankle fractures treated with ORIF. The sixty-six 44C fractures in that report had an increased incidence of arthritis and decreased clinical function at 2- to 6-year follow-up.⁸ Lindsjö¹³ felt that the factors important in predicting results were fracture type, reduction adequacy, and patient sex. This finding of no difference may represent a type II error, as our study group included only thirteen 44C fractures.

Ponzer and colleagues,¹⁴ studying 44B fractures, found that the outcomes after healing are less benign than previously thought. Only 37% of patients with 44B fractures reported “full recovery,” 40% had work-related problems, and 60% had leisure- or sport-related problems up to 2 years after injury. Our data reflect this as well, as patients had not returned to normal Mobility values by 6 or 12 months after injury. Van der Sluis and colleagues⁸ advised surgeons and patients not to disregard these “lesser” injuries, as they “may be more serious than we tend to assume.”

Chissell and Jones¹⁵ reviewed 59 patients 4.5 years after surgical stabilization of Weber type C (44C) ankle fractures to determine predictors of outcome. They found that patients with fractures of the medial malleolus did significantly ($P \leq .05$) worse than those with deltoid ligament ruptures.

Broos and Bisschop¹⁶ reviewed clinical, radiographic, and subjective data on 590 ankle fractures at 1 year in an attempt to correlate fracture types (unimalleolar, bimalleolar, trimalleolar) and final results. They found that patients who had an isolated medial malleolar fracture did worse than those with a fracture of the lateral malleolus. They also showed that a bimalleolar fracture including the medial malleolus predicted a worse outcome than a bimalleolar fracture involving the posterior malleolus and the lateral malleolus without fracture of the medial malleolus. Our data showed no statistically significant differences, but mean scale scores were slightly lower (better) in those with a fracture of the medial malleolus on all scales except Mobility, which may contradict the findings of Broos and Bisschop.¹⁶

Belcher and colleagues⁵ recruited 40 patients 8 to 24 months after uncomplicated ORIF for ankle fractures and had them wear pedometers after radiographic healing. Overall, these patients had significantly lower outcome scores compared with those of age- and sex-matched controls. The authors found no age-related differences but

did find that women did worse than men. Women also had significantly lower activity scores and took fewer mean steps per day than men. Our data do not support a significant difference in recovery rate, recovery level reached, or Mobility scores because of patient sex, though women did average higher scores for all scales. This result may reflect the sensitivity of the instrument (SMFA).

Bhandari and colleagues¹⁷ observed 30 healthy patients with unstable ankle fractures, determined predictors of health-related quality of life as measured with SF-36, and found that social factors such as alcohol consumption and smoking may be important determinants of outcome. This finding is consistent with a finding in our study—that Emotional Status scores do not reach a plateau within the first year after an ankle fracture. It is reasonable to predict that social factors such as alcohol consumption have a significant impact on functional scores.

CONCLUSIONS

What remains to be determined is whether our group of patients will show significant improvement after 1 year. The rate of improvement in SMFA scores after 6 months may have been so slow that all significant improvement in scales other than Emotional Status occurred within the 6-month period. Such information will help in patient counseling and in determining the appropriate timing for completion of maximal medical improvement in worker compensation cases.

Unstable ankle fractures reach a relative plateau in their recovery rate between 4 and 6 months after surgery. Age over 50 years is the factor most predictive of poorer functional outcome and longer time to return to work. There is no significant correlation between presence or absence of a fracture of the medial malleolus, fracture type, or patient sex as measured by the SMFA either with recovery rate or with mean SMFA functional outcome at 6 and 12 months. All scales except Arm/Hand Function improved significantly and plateaued at 6 months after injury. Six months after internal fixation of an ankle fracture is a reasonable time to consider that a patient with an uncomplicated postoperative course has reached maximal medical improvement.

AUTHORS' DISCLOSURE STATEMENT AND ACKNOWLEDGMENT

The authors report no actual or potential conflict of interest in relation to this article.

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