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A Scoring Scale for Symptom Evaluation After Ankle Fracture

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Summary. A scoring system for evaluating symptoms after ankle fractures is presented. It is tested against (1) a linear analogue scale; (2) the limitation in range of motion in loaded dorsal extension; (3) the presence of osteoarthritis; and (4) the presence of dislocations on radiographs. It correlates well with these four parameters, which are considered to summarize the results after this type of injury, and is therefore considered to assess the symptoms in an objective way. The soring system is recommended for scientific investigations, as even minor subjective differences in disability experienced by the patient are significantly separated. The use of this system will simplify the comparison of results presented by different authors.

Zusammenfassung. Ein Bewertungsschlüssel für die Beurteilung von Befunden nach Knöchelfrakturen wird vorgestellt. Diesem Bewertungsschlüssel werden folgende Maßstäbe zugrunde gelegt: 1. die subjektive Beurteilung durch den Patienten auf einer Skala, 2. die Einschränkung der Dorsalextension unter Belastung, 3. das Vorliegen arthrotischer Veränderungen und 4. von Gefügestörungen im Röntgenbild. – Der Bewertungsschlüssel steht mit diesen vier Parametern, die die Ergebnisse nach dieser Verletzung beurteilen, in Einklang. Daher wird dieser Bewertungsschlüssel als ein objektives Verfahren für die zusammenfassende Beurteilung der Befunde angesehen. Der Bewertungsschlüssel wird für wissenschaftliche Untersuchungen empfohlen, weil selbst geringere Unterschiede in der subjektiven Behinderung des Patienten klar hervorgehoben werden. Die Benutzung dieses Systems wird den Vergleich zwischen den Ergebnissen verschiedener Autoren vereinfachen.

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Several publications on operative treatment of ankle fractures have been presented over the years. Quite a few deal with long-term follow-up. A fairly common way of presenting the results with regard to subjective evaluation by the patients is to classify them into groups named for instance "excellent," "good," "fair," and "poor." Such classifications are used by Cedell [2], Lindsjö [7], Zenker and Nerlich [13], and others.

However, this is a very rough method and there are obvious difficulties in comparing different series. For scientific purposes there is a need for a more detailed system describing the patient's subjective evaluation.

In this paper we present a scoring system worked out for patients with ankle fractures. Different symptoms have received different points according, to the extent of disability we consider they will lead to.

Similar systems have been worked out for other types of conditions, e.g., by d'Aubigné and Postel [3] for hip arthroplasties and by Larson [6] and Lysholm and Gillquist [8] for knee injuries.

The scoring scale has been evaluated by comparing the score of 90 patients operated on for ankle fracture with:

1. Subjective evaluation according to a linear analogue scale.
2. Range of motion in loaded dorsal extension, revealed by clinical examination.
3. Signs of osteoarthritis.
4. Presence of dislocations, revealed by radiographic examination.

Material and Methods

The material consists of 90 patients operated on for ankle fractures. Only patients with multicomponent fractures were chosen (according to Lauge Hansen's classification system [5]: SA II, SE III–IV, PA III, and PE III–IV).

Table 1. The scoring system

Parameter	Degree	Score
I. Pain	None	25
	While walking on uneven surface	20
	While walking on even surface outdoors	10
	While walking indoors	5
	Constant and severe	0
II. Stiffness	None	10
	Stiffness	0
III. Swelling	None	10
	Only evenings	5
	Constant	0
IV. Stair-climbing	No problems	10
	Impaired	5
	Impossible	0
V. Running	Possible	5
	Impossible	0
VI. Jumping	Possible	5
	Impossible	0
VII. Squatting	No problems	5
	Impossible	0
VIII. Supports	None	10
	Taping, wrapping	5
	Stick or crutch	0
IX. Work, activities of daily life	Same as before injury	20
	Loss of tempo	15
	Change to a simpler job/ part-time work	10
	Severely impaired work capacity	0

Nine subjective parameters were chosen and scored as shown in Table 1. The total score of each patient was compared with the results from the four parameters listed above.

Linear Analogue Scale

The patients were asked to mark their subjective evaluation of their ankle function on a 15-cm-long linear analogue scale with the ends marked "perfectly normal ankle" and "totally disabling ankle." The distance between the mark and the end of the scale was measured manually to the nearest millimeter using a standard ruler. The subjective evaluation was registered in percent of "perfectly normal ankle."

Range of Motion in Loaded Dorsal Extension

The patients were examined with regard to the range of motion in loaded dorsal extension in the following way. The head of the fibula was marked with India ink, and the patient stood with the foot to be measured on a 15-cm-high stool, knee and hip flexed. The patient leaned forward, putting full weight on the foot, to the point where the heel was just in contact with the stool surface. The angle between the surface of the stool and a line going through the tip of the lateral melleolus and the mark at the head of the fibula was measured manually using a standard goniometer [7]. Measurement was carried out on both sides, and the uninjured ankle was considered as the control. The difference between the injured and uninjured ankle was recorded.

Presence of Osteoarthritis

Radiographic examination was carried out in the following way. Standard anteroposterior and side views and an inward rotation view were taken on the injured side, an inward rotation view on the uninjured side. The radiographs were examined for signs of osteoarthritis. Osteoarthritis grade I was considered a loss of joint space of less than 50% compared to the uninjured side. Grade II corresponded to a loss of more than 50% but still no bone-to-bone contact. In grade III there was bone-to-bone contact, and in grade IV a loss of bone substance was seen.

Presence of dislocations

The radiographs were also examined for signs of dislocations and incongruences. Angulation, rotation, lateral displacement, and shortening of the lateral and medial malleolus were recorded. Proximal displacement of posterior fragments was also recorded. When parallellism between the medial and the lateral joint surfaces of the talus and the joint surfaces of the medial and lateral malleolus respectively was absent and malalignment as decribed above was present, the joint was considered to be incongruent (Olerud et al., manuscript submitted for publication).

Statistics. All calculations concerning comparison between averages have been done using Student's *t*-test; * means $P<0.05$, ** means $P<0.01$, and *** means $P<0.001$. If the test was single-tailed this is noted in the figure legend. In the figures the mean values and standard deviations are shown.

Results

Score Compared with Linear Analogue Scale

Depending on where the patients had marked their subjective evaluation of their ankle function on the linear analogue they were divided into four groups:

Poor: 0%–30%, Fair: 31%–60%, Good: 61%–90%, Excellent: 91%–100%.

The average scores were 30 in the poor, 62 in the fair, 78 in the good, and 92 in the excellent group (Fig. 1).

Score Compared with Range of Motion in Loaded Dorsal Extension

The patients were divided into three groups with regard to the limitation of their range of motion in forced dorsal extension. Group 1 included patients with the same range of motion as on the uninjured side,

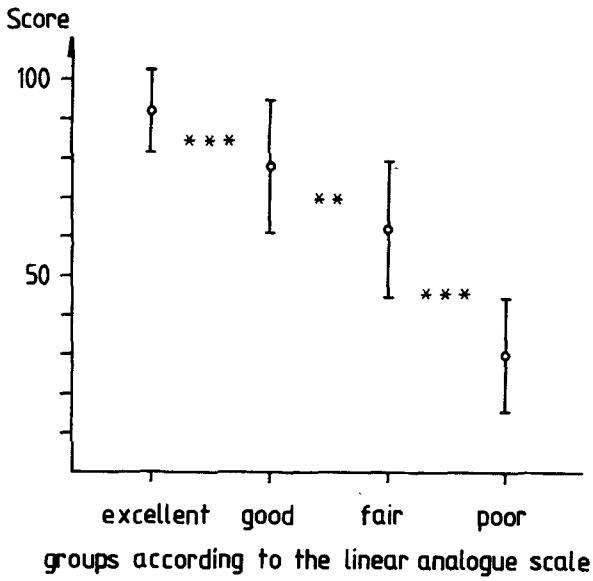

Fig. 1. Correlation between the score and subjective evaluation according to the linear analogue scale. Excellent = 91%–100%; good = 61%–90%; fair = 31%–60%; poor = 0%–30%

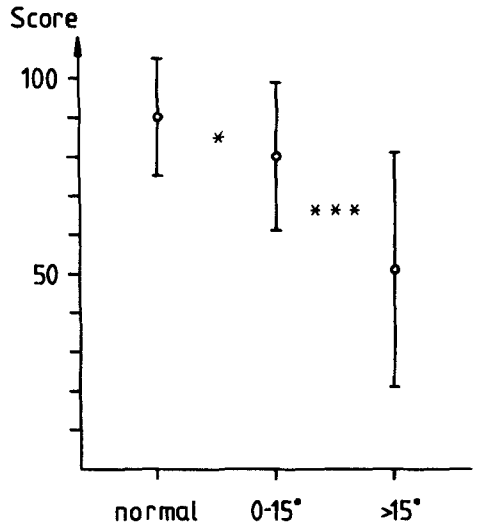

Fig. 2. Correlation between the score and lack of range of motion in loaded dorsal extension

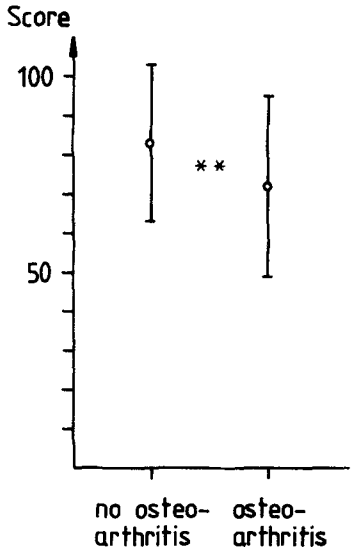

Fig. 3. Correlation between the score and the presence of osteoarthritis. Student's *t*-test was single-tailed

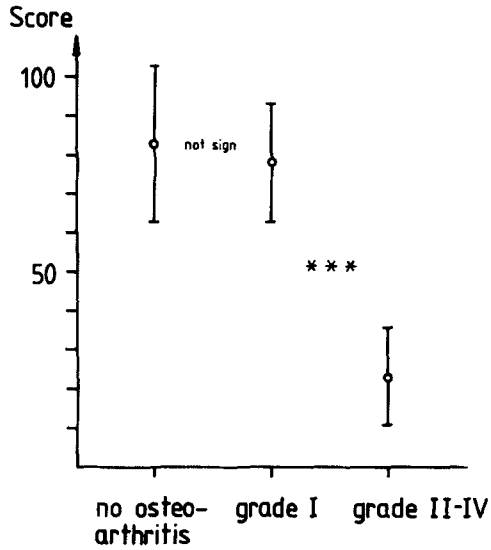

Fig. 4. Correlation between the score and different grades of osteoarthritis. Grade I osteoarthritis is a loss of the joint space of less than 50%, grades II–IV are more severe forms

group 2 those who had up to 15° limitation in range of motion, and group 3 those who had over 15° limitation. The average score was 90 in group 1, 79 in group 2, and 51 in group 3 (Fig. 2).

Score Compared with Presence of Osteoarthritis

The patients were grouped with regard to presence of osteoarthritis. The average score in the group without signs of osteoarthritis was 83 and that the group with signs of osteoarthritis was 72 (Fig. 3). Taking the grade of osteoarthritis into account, the average score in grade I osteoarthritis is 78 and that in grade II–IV osteoarthritis is 23 (Fig. 4).

Score Compared with Presence of Dislocation

The radiographs were examined for signs of dislocations and incongruency and the patients were grouped accordingly. The average score in the group without dislocations was 86, and that in the group with dislocations, disregarding the type of fracture, was 72 (Fig. 5). The average scores in the different dislocations are seen in Fig. 6. Significant differences from

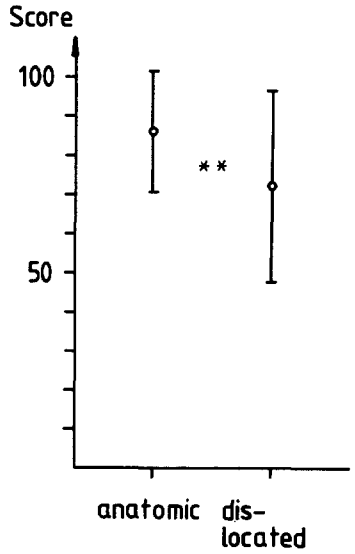

Fig. 5. Correlation between the score and presence of dislocation

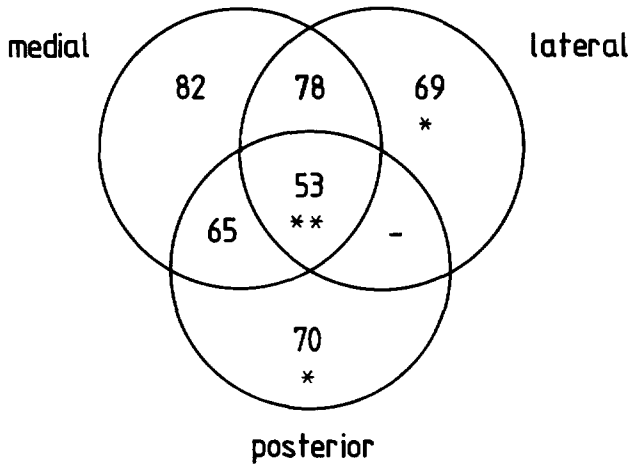

Fig. 6. The score in different dislocations. The *asterisks* indicate significant differences from the average score in the group without dislocation ($n = 86$)

the group without dislocations are marked in the figure.

Discussion

Any study concerning follow-up after operative treatment of ankle fractures will deal with the symptoms and signs, clinical or radiographic, that the patient shows. As far as the clinical examination is concerned it is quite easy to record the different parameters in terms of degrees, centimeters, or whatever is appropriate.

What really counts, however, is the total clinical end result, which is more difficult to describe as relevant functional aspects have to be included. These subjective symptoms seem to be a major problem as regards recording them in a reproducible way. The most common way is to divide the patients into the four groups—excellent, good, fair, and poor—depending on the degree of symptoms. However, definitions vary between different authors, and comparison between different materials is thus often difficult. Also, small differences in the same series may not show up with such a crude system.

The present paper describes a scoring system where important functional symptoms have been assigned different numbers of points. The scoring system is logically designed; the first three questions deal with primary complaints, the next four questions cover ability to perform simple tasks, and finally two questions concern the patient's situation in everyday life. The number of points allocated to each symptom has been chosen in such a way that it should equal the disability rate. Obviously this process will be subjective, but it is based on the experience of the investigators. As far as we know no method is available that will assign each parameter in the system the "correct" number of points, but we are of the opinion that if the score correlates to several objective parameters, it will nevertheless be a useful instrument.

The score shows significant correlation to the patient's own subjective evaluation on the linear analogue scale. This method for subjective analysis is described in detail by Revill et al. [10] and is generally accepted.

The score also correlates significantly to the range of motion in loaded dorsal extension. This objective, easily measured angle is considered to be the most important clinical sign for assessment of the end result [7, 13].

We found lower scores in patients with osteoarthritis than in those without. This finding is supported by a number of authors, for example Cedell [2] and Lindsjö [7]. If the patients are divided according to the degree of osteoarthritis, there is no significant difference in average score between the group with grade I osteoarthritis and the group without osteoarthritis. However, there is a highly significant difference between grade I osteoarthritis and more severe forms. Lindsjö [7] reports similar observations.

The finding that the score correlates well with presence of dislocations is supported in many other reports. Vasli [11], Willenegger [12], Burwell and Charnley [1], Lindsjö [7], and Zenker and Nerlich [13] all conclude that anatomical reduction is mandatory for a good final outcome.

The score is also significantly lower in patients with lateral incongruency, dislocation of a posterior fragment, or the most severe dislocations. This supports

the statements by Johansson and Olerud [4] that the lateral malleolus is the most important structure to repair in ankle fracture and by Plaue [9] that the presence of a dislocated posterior fragment is associated with a poor prognosis.

The scoring system presented in this paper correlates significantly with four different parameters considered to give a good estimation of the clinical results after ankle fractures. We therefore consider it a good overall instrument for evaluating the subjective symptoms, and we recommend it for scientific purposes.

Another argument for the detailed evaluation the scoring system leads to is as follows: In another investigation (Olerud et al., manuscript submitted for publication) in which these patients were included, we used a "rougher" system for describing the symptoms, and found no difference at all in disability rate between the ankles which were anatomically reduced and those which were not. However, a significant difference appeared in this group when the scoring system was applied, as well as significant differences in the results of the linear analogue scale and the range of motion in loaded dorsal extension. In our opinion, this indicates clearly the benefits of this detailed and standardized system.

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