

THE RANGE OF MOTION FOLLOWING FRACTURE OF THE SHAFT OF THE FOREARM IN CHILDREN

BO E. NILSSON & KARL OBRANT

Department of Orthopaedic Surgery, Malmö General Hospital,
(University of Lund), Malmö, Sweden.

Eighteen children with fracture of the shafts of the forearm were re-examined in adulthood. All fractures had primarily been displaced but reduced to a good position without residual axial or *ad latem* displacement. At follow-up there was no sign of deformity in the radiograms of the two bones. However, the range of motion for supination and pronation was significantly decreased. This implies that factors other than residual deformity are responsible for this dysfunction.

Key words: fracture; forearm; diaphysis; deformity

Accepted 23.vi.77

Högström et al. (1976) found that limitation of pronation and supination was a common finding after diaphyseal forearm fractures in childhood. The dysfunction was related to angulation caused by incomplete reduction of the fracture. This relationship, however, was weak with a large residual variance leaving most of the limitation unexplained. Therefore it was decided to investigate whether or not limitation of these movements could be found after fractures of the shafts of the forearm in childhood which had been properly reduced and which had healed in a good position.

MATERIAL AND METHODS

During the years 1954-1960 about 40 cases of diaphyseal fracture of the forearm in children

below the age of 13 were recorded. Of these, 28 fulfilled the criteria that there had been a substantial initial fracture displacement and that this displacement had been reduced completely. Of these patients, 18 (11 men and 7 women) volunteered for a follow-up examination in 1976. In this group the primary dislocation evaluated in the pre-reduction radiogram as the maximum angulation in either antero-posterior or lateral films of the forearm, average of radius and ulna, was $28 \pm 12^\circ$. In addition, in six of these patients there was an obvious *ad latem* dislocation of one or both bones. Rotational displacement was estimated on the same films from the alignment of the radius and from possible differences in the width of the shaft of the radius immediately proximal and distal to the fracture (Evans 1951). Only in two cases was there a noticeable rotational malposition. Closed reduction had been used in all instances.

The age at fracture was 8 ± 3 years and the age at follow-up 27 ± 4 . The shortest interval was 16 years.

The follow-up included a clinical and radiological examination. Any complaints of the patient were recorded and the pronation-supination was measured in a specially designed cradle in which the patient turned a handle with his elbow in a fixed position. The precision of this

Financial support was obtained from the Swedish Medical Research Council (project no. B 76-17X-2737-08A), the Greta and Johan Kock Foundation and the Alfred Österlund Foundation.

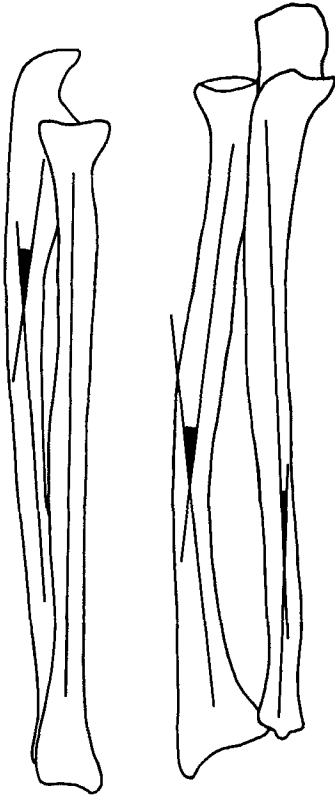


Figure 1. Diaphyseal angulation, method of measurement. In the *a-p* projection the ulna has usually two curvatures. Only the distal one was included. In this case the angulation in the lateral projection of the radius is 0.

method is, in normal individuals, about 12° or 6 per cent (coefficient of variation). Since malposition visible at the former site of the fracture could not be expected and was not found, the shape of the radius and the ulna with regard to curvature was recorded as shown in Figure 1. Measurements of angulation obtained in this manner were used for a comparison between the injured and the uninjured forearms.

RESULTS

None of the patients had sought medical attention because of their forearms during the time interval between the healing of the fracture in childhood and the follow-up examination. Only one had any complaints whatsoever. This patient felt some weakness of the forearm and hand

INJURED

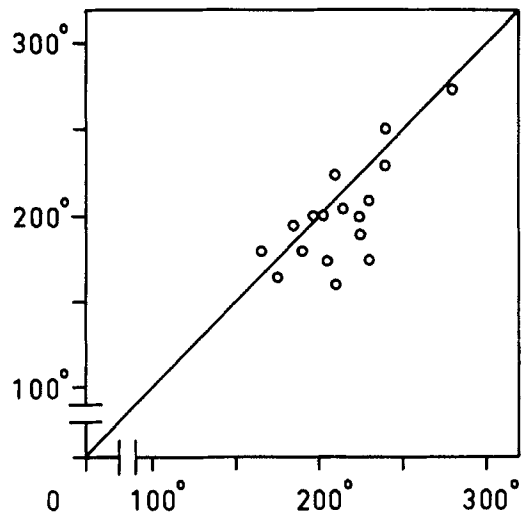


Figure 2. Pronation-supination, deviation from the null-hypothesis.

Table 1. Pronation-supination in the fractured and the non-fractured forearms.

	Average	SD
Fracture	195°	± 37°
Non-fracture	214°	± 27°
Difference	19°	

and had (compare below) the greatest limitation of range of motion of all those tested. In the entire group the range of pronation and supination motion was somewhat decreased in the previously fractured forearms and this decrease was significant. The difference was about 20° (Table 1). The distribution of pronation and supination in relation to the null hypothesis is also demonstrated in Figure 2.

The curvature of the ulna seen from the lateral aspect was significantly less in fractured arms but the difference was negligible. Otherwise there was no difference in the various angles which could

be measured on the radiograms between fracture and non-fracture forearms (Table 2). It must therefore be concluded that the fracture had not changed the shape of the two forearm bones. The difference in the range of pronation and supination movement between the fracture and the control forearms was not related to the initial angulation or to whether or not there had been an initial *ad latem* dislocation. Also, limitation of pronation and supination was unrelated to the age at the time of fracture. In the two cases with rotational malposition the pronation and supination was decreased by 10° in one and by more than 15° in the other as compared with the uninjured side.

Table 2. Angulation, difference between fractured and non-fractured forearms.

	Radius	Ulna
Anteroposterior	0.4° ± 2.9°	0.1° ± 3.1°
Lateral	0.3° ± 4.9°	-1.4° ± 2.6°

One patient, a 26-year-old man, had sustained a fracture of the distal third of the diaphysis of the radius and the ulna at the age of 9 and a primary angulation of about 30° had been reduced completely. There were no radiological signs of deformity whatsoever at the time of follow-up. Nevertheless, this patient had a limitation of his range of motion of 120° and was the only patient to complain of residual symptoms.

DISCUSSION

The clinical findings in this study agree with those of Högström et al. (1976) in that even patients with a decrease in the range of pronation-supination motion of 50° had not noticed their dysfunction. This might be the reason why this has not been observed in the past. Högström et al. (1976) found a limitation of pronation and supination of about 25° following forearm fractures which had healed with a residual angulation of on the average 20°. In the present study the limitation of pronation and supination recorded at follow-up was almost as much. This implies that the contribution to this dysfunction of angulation of the two bones is of minor importance since completely reduced forearms which had healed without any malposition whatsoever still have a measurable and significant limitation of their range of pronation-supination motion. The importance of rotational deformity, however, could not be studied in this series since only two cases had been reduced with a noticeable residual rotational malposition.

REFERENCES

- Evans, E. M. (1951) Fractures of the radius and the ulna. *J. Bone Jt Surg.* **33-B**, 550-561.
- Högström, H., Nilsson, B. E. & Willner, S. (1976) Correction with growth following diaphyseal forearm fracture. *Acta orthop. scand.* **47**, 299-303.