External fixation of Colles' fracture

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Radiographic and functional results of external fixation of 32 Colles' fractures were compared with the results of plaster fixation of 189 Colles' fractures. Despite the fact that the fractures treated with the external device were more unstable and comminuted, the final results were equal in both groups, and the radiographic outcome of external fixation was superior. Pin loosening decreased with predrilling rather than self-tapping. We recommend external fixation for unstable fractures of the distal forearm.

Fractures of the distal forearm often redislocate during plaster-cast treatment (Jenkin et al. 1987, Jonsson 1983, Kaukonen et al. 1988a). The search for better fixation methods has included pins and plaster, finger traps for distraction, external fixation (Jakob and Fernandez 1982, Nakata et al. 1985, Kongsholm and Olerud 1987), and lately, dynamic fixators (Clyburn 1987). The Hoffmann device used here has been widely used (Nakata et al. 1985), and it has proved to be comparable in all aspects with other available devices.

We have compared treatment with external fixation and plaster casts in a prospective, nonrandomized series of Colles' fracture.

Patients and methods

The first consecutive 42 patients with fracture of the distal forearm treated with external fixation at our hospital were examined. These included 32 Colles' fractures, which entered the study. Beginning at the same time, but over a shorter time period, 207 consecutive patients treated with plaster casts were analyzed as a control series. These included 189 Colles' fractures, of which 16 were excluded because of injury to the contralateral wrist. Only patients over 15 years of age were included. The mean age of the patients of the plaster group was 57 years and that of the fixation group 52 years. There were slightly more women in the plaster group.

In the plaster group the fracture was reduced under local anesthesia, and fixation with a dorsolateral cast for 5 weeks was the standard treatment.

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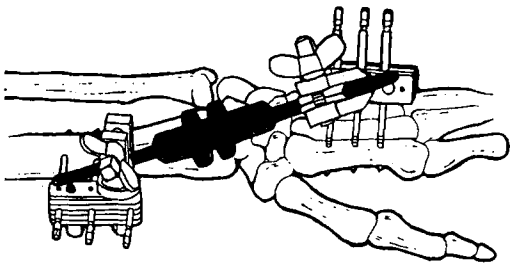

Figure 1. The medium size Hoffman device.

In the group treated with external fixation, a medium-sized Hoffmann device with three self-tapping 3.5-mm pins in both the radius and the second metacarpal bone was used. The fixator was inserted under fluoroscopic control with intravenous, plexus, or general anesthesia. The average duration of fixation was 6 weeks.

The fractures were classified according to Frykman (1967; Table 1). The fixation group contained more intraarticular fractures with two-thirds comminuted articular fractures, Types III and IV according to Older et al. (1965, cf. Solgaard [1984, 1986]). The mean primary dorsal angulation difference from the control was 31° in the plaster group and 41° in the fixation group. The mean control value for the normal wrists was 12° of volar angulation. The mean primary shortening of the radius was 2 mm and 4 mm, respectively.

Table 1. The distribution of Colles' fractures into Frykman types in the two treatment groups

Frykman type	I	II	III	IV	V	VI	VII	VIII
Plaster cast group (n173)	21	37	17	34	4	14	6	40
External-fixation group (n32)	–	5	4	8	–	–	6	9

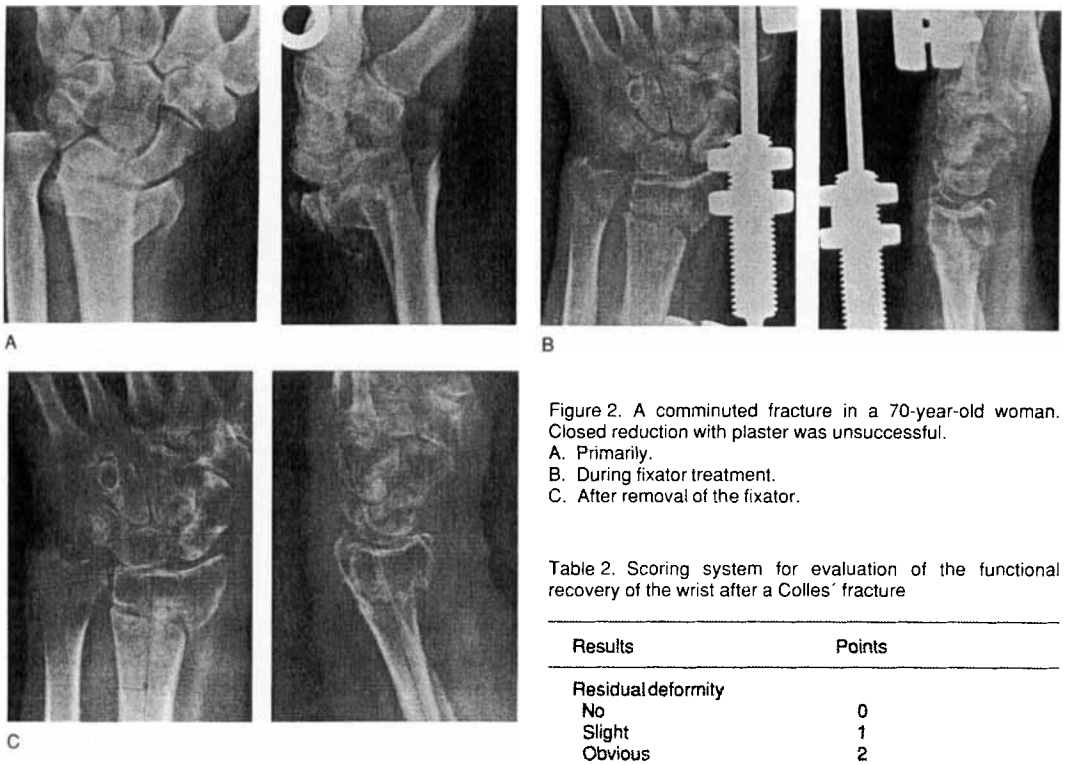

Figure 2. A comminuted fracture in a 70-year-old woman. Closed reduction with plaster was unsuccessful.
A. Primarily.
B. During fixator treatment.
C. After removal of the fixator.

The radiographic analysis comprised examinations primarily after reduction, during the treatment, after removal of the fixation device, and 6 months after the accident. The other wrist, when uninjured, was used as the control, and the measurements were recorded as differences from the control. Loss of position during treatment was recorded when dorsal angulation exceeded 10° or radial shortening 3 mm.

The functional assessment was performed 6 months after the accident, and included range of motion, grip strength, pain, subjective symptoms, and complications according to a scoring system (Table 2; Gartland and Werley 1951, Kaukonen et al. 1988b). The chi-square test was used as the statistical method.

Table 2. Scoring system for evaluation of the functional recovery of the wrist after a Colles' fracture

Results	Points
Residual deformity	
No	0
Slight	1
Obvious	2
Pain upon movement	
No	0
Slight	2
Frequent	3
Distrurbing	4
Crippling	5
Subjective evaluation	
Excellent	0
Good	2
Fair	4
Poor	6
Physiotherapist's evaluation	
Excellent	0
Good	2
Fair	3
Poor	5
Complications	
No	0
Yes	1
Median nerve	3
	0–21
End result	Point ranges
Excellent	0–2
Good	3–8
Fair	9–18
Poor	19–21

Results

Complications related to the device were as follows: one late collapse of minimal degree, one transient synovitis due to a pin penetrating too deeply, loosening of the pins once in 3 patients and twice in 2 patients, and three superficial pin-site infections. No deep infections nor pin-site fractures were noted.

The radiographic result was superior in the fixation group ($P < 0.01$; Table 3). The mean remaining shortening of the radius was 1.8 mm in the plaster group and 2.4 mm in the external-fixation group. Loss of the position during the immobilization was noted in 105 (61 percent) patients of the plaster group, but only once during external fixation.

The function was excellent or good in three fourths

Table 3. Radiographic results according to remaining dorsal angulation difference in degrees compared with the control side

Angulation difference	0–19°	20–25°	25°	N
External fixation	26	6	0	32
Plaster cast	87	67	19	173

Table 4. Function related to the mode of treatment

	Excellent	Good	Fair	Poor
External fixation	18	6	7	1
Plaster cast	69	67	37	0

of the cases in both groups. There were more excellent results after external fixation, but the only poor result was also noted in this group (Table 4). The average range of supination was 62° (30-100°) in the plaster group and 53° (20-95°) after external fixation. In the other single functional measurements, there were no marked differences between the groups.

Discussion

Our observations confirm those reported by Gartland and Werley (1951), Jonsson (1983), and Vaughan et al. (1985). The results after external fixation were comparable to the plaster-cast results despite the more serious nature of the former fractures in accordance with reports by Johnson (1983), D' Anca et al. (1984), and Kongsholm and Olerud (1987).

The number of pin loosenings decreased with growing technical experience. Predrilling of the holes, instead of self-tapping pins, might also make the pins more stable.

The poor radiographic results of the plaster-cast treatment suggest the following criteria for external fixation: Dorsal angulation of more than 40°, multiple lines into the distal radiocarpal joint, and deterioration of the position during plaster-cast treatment (shortening of more than 4 mm or dorsal angulation of more than 10°).

External fixation using a distraction bar makes it possible to produce a traction effect on the comminuted distal radius; this effect has also been named ligamentotaxis. However, it usually did not seem necessary to add distraction during treatment. Too strong distraction may cause late collapse.

External fixation appears to be a proper treatment in severe and unstable Colles' fractures, and its use should probably be increased.

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