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Plaster cast compared with bridging external fixation for distal radius fractures of the Colles' type

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Abstract We compared two different treatments for displaced distal radius Colles' type fractures (Older type 3 and 4), at two hospitals. We found bridging external fixation superior to reduction and fixation in a dorsal plaster cast regarding both the end-anatomic results at 3 months and the functional scores at 3 and 9 months (modified Gartland and Werley).

Résumé Nous avons effectué dans 2 hôpitaux, une analyse contrôlée de 2 traitements différents des fractures comminutives du radius distal (Older type 3 et 4). Nous avons trouvé une supériorité du pontage par fixateur externe sur l'immobilisation par plâtre tant pour le résultat anatomique à 3 mois que pour le résultat fonctionnel après 3 et 9 mois (score de Gartland et Werley).

Introduction

There have been several suggestions for the treatment of displaced fractures of the distal radius (Colles' type). Reduction and plaster cast fixation [3, 5, 10, 14, 16, 17, 27], pins and plaster casts [11, 14, 19, 25], open reduction and fixation with or without bone grafting [4, 6, 12, 14], Rush pins [9, 18], dynamic external fixation [2, 15, 24], bridging external fixation [1, 6, 11, 20, 23] and non-bridging external fixation [7, 8, 13]. In most studies, the

external fixator has been found to be superior to plaster cast fixation in achieving a good end-anatomic result [1, 6, 7, 8, 23]. However, there has been some controversy as to whether the end-functional score depends on the end-anatomic results [6, 8, 14, 20, 23]. We conducted this trial to compare whether a dorsal plaster cast treatment or a bridging external fixation would give the best functional outcome.

Patients and methods

The fracture classification was made according to the Older system [17]. Enrolled in the trial were all patients presenting at the accident and emergency unit with a displaced distal radius fracture (Older type 3 and 4). Excluded were patients who had formerly sustained a fracture to the wrists, had other ipsilateral fractures/dysfunction of the upper extremity, were mentally disabled or an abuser of alcohol.

According to the regulations of the department, treatment at the University Hospital in Glostrup included reduction and a dorsal plaster cast for 5 weeks. The treatment at the University Hospital in Herlev involved a bridging external fixation for 4 weeks followed by a dorsal plaster cast for 1 week, after removal of the fixator. X-rays were taken after reduction, at day 11, 5 weeks and 3 months. For comparison, a radiograph of the uninjured wrist was taken. The functional scores were recorded after that of the Solgard modified Gartland and Werley system [22] at 3 and 9 months. The local ethical committee approved the protocol (KA 89298).

Results

Forty-three patients were enrolled in the trial. Twenty-seven in the plaster fixation group and 16 in the external fixation group. The demographic data are listed in Table 1. There was no statistical difference between the two groups.

Table 2 shows the results. The Δ DA is the difference in dorsal angulation after reduction between the injured and the uninjured wrist. The Δ RA is the difference in radial angulation after reduction between the injured and the uninjured wrist. The Δ ARL is the difference in the axial radial length after reduction between the injured

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and the uninjured wrist. This value is obtained as the distance between the base of the ulna and the radial styloid [28]. The Δ values at 3 months are the differences between the values after reduction and the values at 3 months. The only statistically significant result was in the Δ DA at reduction, in favor of the external fixation group. The Σ at 3 months is the total difference at 3 months compared to the uninjured hand. Both the Σ DA and the Σ RA are statistically significant in favor of the external fixation group.

Table 2 also shows the results of the functional score at 3 and 9 months (median values). At 3 months, both groups had a fair score but at 9 months, the score of the plaster fixation group was still fair whereas the external fixation group scores were good. Both results are statistically significant at a 1% level in favor of the external fixation group. In the plaster cast treated group 8 patients had signs of median nerve compression at the 3-month examination. At the 9-month follow up, 1 still had symptoms.

At the 3-month examination, 4 patients in the external fixation group had sensory changes in the skin innervated by the superficial radial nerve. Of these, 3 still had this complaint at the 9-month control. One patient had symptoms of median nerve compression and one had a superficial pin tract infection treated with antibiotics. There was no further operation because of the complications, and none developed reflex sympathetic dystrophy.

We used the chi-square test for the categorical data in Table 1. We used the Mann-Whitney *U*-test for unpaired data in Table 2, in that we made a regression of the interval data obtained from the X-ray calculations to a ratio scale, because the assumption of a normal distribution is

uncertain. The β -value (type 2 error) was calculated for the non-significant data in order to test the power of the analysis. As the two groups were unequal we found the harmonic mean, which was 20, corresponding to 20 patients in each group. With a risk of a type 1 error of 5% and a minimal clinically relevant difference in order of the dispersion, the type 2 error was found to be 10% according to a power of 90%.

Discussion

In this study, the allocation principle was not optimal. However, we have tested the two groups (Table 1) and found no significant differences between them.

Concerning the reduction control it is obvious that these dislocated fractures displace in the plaster cast. This is in agreement with several other papers [1, 6, 7, 8, 23]. Compared with the external fixator group the patients treated with a plaster cast had a more pronounced dorsal angulation, probably due to the comminuted dorsal cortex. This could be the reason that the deterioration during the immobilization period did not differ between the two groups – the deterioration in the plaster cast group had already taken place. The radial angulation worsened during the observation period but there was no statistical significance between the groups. Remarkably, we did not find any statistically significant difference between the two groups regarding the radial length. This is in contradiction to other investigators who had found the shortening of the radial length to be the most important factor in favor of external fixation [7, 21, 26].

There has been some controversy about the functional results comparing plaster casts and external fixations. Some authors have found the results to be similar [8, 14, 20] while others have found the external fixation to be superior to plaster fixation [1, 6, 23]. We found that bridging external fixation offers a better functional score at 3 and 9 months follow-up in comparison with plaster cast fixation for displaced distal radial fractures reaching statistical significance at a 1% level at both control examinations.

In contrast to other investigators, we did not find the slip during the fixation period to be different in the 2 groups. This was probably due to the observed differ-

Table 1 The description of the population. Years in mean with the range in brackets. NS non-significant

	Plaster cast	External fixation	Test result
Number	27	16	
Male/female	1:26	2:14	NS
Older 3	20	8	NS
Older 4	7	8	NS
Age (years)	63.7 (22–83)	58.8 (33–84)	NS

Table 2 Results. Δ loss reduction is the difference in comparison with the uninjured hand. Δ 3-month is the dislocation from the initial reduction. The Σ loss 3-month is the total difference compared with the uninjured hand at 3 months. The value marked * are medians; the rest are means. NS non-significant, S significant

	Plaster cast	External fixation	Test results
Δ DA loss reduction	14.2° (5–30)	7.4° (0–22)	S (1%)
Δ RA loss reduction	2.8° (÷2–9)	1.4° (÷7–15)	NS
Δ ARL loss reduction	1.3 mm (0–6)	0.4 mm (÷5–10)	NS
Δ DA 3-month	4.1° (0–20)	3.0° (0–12)	NS
Δ RA 3-month	3.4° (0–15)	1.3° (0–12)	NS
Δ ARL 3-month	1.3 mm (0–4)	2.1 mm (0–8)	NS
Σ DA loss 3-month	18.0° (5–35)	10.4° (2–28)	S (5%)
Σ RA loss 3-month	6.2° (÷2–18)	2.8° (÷5–15)	S (5%)
Σ ARL loss 3-month	2.7 mm (0–7)	3.6 mm (÷2–10)	NS
Score 3-month*	16.0 (4–26)	11.5 (4–19)	S (1%)
Score 9-month*	12.0 (1–26)	5.0 (0–13)	S (1%)

ence after the initial reduction. Therefore, the end-anatomic results after 3 months are different between the groups as found by others [1, 6, 7, 8, 23]. We conclude that bridging external fixation is superior to reduction and plaster cast fixation for displaced distal radius fractures of the Colles' type. Other investigators have found the non-bridging technique to be superior to the bridging technique, although some controversy exists concerning the functional outcome [8, 13]. However, this could be the technique of choice for the future.

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