An advice and exercise program has some benefits over natural recovery after distal radius fracture: a randomised trial

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Question: Does an advice and exercise program improve outcome for adults following distal radius fracture? **Design:** Randomised trial with concealed allocation, assessor blinding, and intention-to-treat analysis. **Participants:** Fifty-six patients whose fracture had been managed with pins and/or cast. **Intervention:** The experimental group received a physiotherapist-directed program of advice and exercises. The control group did not receive any physiotherapy intervention. **Outcome measures:** The primary outcome was wrist extension (measured with a goniometer). Secondary outcomes were the other wrist ranges of motion (measured with a goniometer), grip strength (measured with a dynamometer), pain, and activity limitations (measured with questionnaires). These outcomes were measured initially, then three and six weeks later. Participants also rated their satisfaction with physiotherapy intervention at Week 6. **Results:** No difference was found between groups for the primary outcome of wrist extension (mean difference 6 deg, 95% CI –3 to 14), nor for the secondary outcomes of other range of motion data and grip strength. The difference between groups for pain was –16 points out of 100 (95% CI –27 to –5) at Week 3, and –14 points (95% CI –25 to –3) points at Week 6, and for activity was –13 points out of 100 (95% CI –24 to –2) at Week 3; in favour of the experimental group. The experimental group was also more satisfied with the amount of physiotherapy intervention. **Conclusion:** An advice and exercise program provided some additional benefits over no intervention for adults following distal radius fracture. **Trial registration**: ACTRN012607000204448. **[Kay S, McMahon M, Stiller K (2008) An advice and exercise program has some benefits over natural recovery after distal radius fracture: a randomised trial. *Australian Journal of Physiotherapy* 54: 253–259]**

Key words: Radius fractures, Physiotherapy, Randomised controlled trial

Introduction

Fractures of the distal radius are one of the most common skeletal injuries (Ark and Jupiter 1993). Despite the frequency, management is diverse and provides an ongoing challenge for both the surgeons and therapists involved in their care. Surgical immobilisation of these fractures ranges from the use of pins (inserted percutaneously) and/or a cast, through to the use of open reduction with internal fixation or external fixation for more complex injuries. Physiotherapy intervention is also diverse and ranges from a single contact at the time of cast removal through to a formal course of outpatient therapy. Other patients may be advised to regain activity by using their hand/wrist as normally as possible and are not referred for physiotherapy intervention at all.

The aim of physiotherapy intervention after the period of immobilisation for patients with distal radius fractures is to regain range of motion, strength, and activity using modalities such as exercise, soft tissue techniques, passive mobilisation, electrotherapy, splinting, and interventions to control swelling (Cifaldi Collins 1993, Laseter and Carter 1996, Reiss 1995, Weinstock 1999). A survey by Michlovitz et al (2001) found that an exercise program and the use of heat/cold modalities were the most frequent interventions provided by therapists for this patient group. While all these interventions are commonly used in the rehabilitation of patients after distal radius fracture, to date there is only limited research evaluating their effectiveness. A number of randomised trials found that the addition of specific techniques such as passive mobilisation (Kay et al 2000, McPhate and Robertson 1998, Taylor and Bennell 1994), ultrasound (Basso and Pike 1998), whirlpool immersion (Toomey et al 1986), and manual lymph drainage (Härén and Wiberg 2006) did not add to the effectiveness of a conventional program provided by therapists. A number of other trials, all of which were randomised (with the exception of Oskarsson et al 1997), have compared the effectiveness of a home exercise program (prescribed by a physiotherapist or surgeon) to a formal outpatient physiotherapy or occupational therapy program, with most finding no significant or clinically-important differences between groups (Bache et al 2000, Christensen et al 2001, Maciel et al 2005, Oskarsson et al 1997, Pasila et al 1974, Wakefield and McQueen 2000, Watt et al 2000). Whilst some of these studies did find significant benefits associated with the provision of formal physiotherapy intervention (Bache et al 2000, Wakefield and McQueen 2000, Watt et al 2000), there were methodological concerns with these studies which included limited outcome measures and a small sample size (Watt et al 2000), findings of uncertain clinical importance (Wakefield and McQueen 2000) and a lack of detail (Bache et al 2000). Thus, from the literature currently available it is still unclear which components of physiotherapy intervention are effective for patients with distal radius fractures after the immobilisation period. Furthermore, we were unable to identify any studies which included a control group where patients received no physiotherapy intervention. This is an important oversight as patients provided with no formal intervention at all may achieve the same result over time with natural recovery as

those receiving physiotherapy interventions. Therefore, our research question was:

> Does a physiotherapist-directed program of advice and exercises after the immobilisation period following fracture of the distal radius managed with pins and/or cast result in a better recovery of range of motion, grip strength, pain and activity?

Method

Design

A prospective, parallel-group, randomised trial was conducted. Participants were recruited into the study following removal of pins and/or cast for management of distal radius fracture. An initial assessment was undertaken as soon as possible after recruitment and prior to randomisation into either the experimental or control group. A computer-generated randomisation table was kept by an independent person who was remote from the area where assessment occurred, and group allocation was revealed by a phone call. Participants in the experimental group received an advice and exercise program from a physiotherapist at the time of the initial assessment. Participants in the control group received no physiotherapy intervention. Outcomes were measured again at three weeks to reflect the immediate effect of the intervention, and at six weeks to reflect longer-term outcomes. Therapist-rated outcome measures were collected by an experienced hand physiotherapist (MMcM) who was blinded to group allocation. To maintain blinding, participants were asked not to discuss any aspect of the trial with the assessor.

Participants

All patients attending an outpatient clinic at the Royal Adelaide Hospital who had sustained a fracture involving the distal radius which was managed with pins and/or cast were eligible for inclusion. Patients were excluded if they: were unwilling or unable to participate; were unable to understand written or spoken English; had bilateral wrist fractures or a concurrent injury to the affected limb; had a previous wrist fracture on the affected side with residual loss of range of motion or function; had a concurrent ipsilateral limb injury, pre-existing inflammatory joint condition, or were managed with internal or external fixation. Baseline information was obtained either directly from participants or from their case notes. X-rays taken at the time of injury were classified by an independent orthopaedic surgeon using the AO system of classification (http://www.aofoundation.org/wps/portal/Home).

Intervention

After removal of pins and/or cast, the experimental group had a single session with an experienced hand physiotherapist (SK). They were provided with standardised advice on fracture protection, swelling control, skin care and everyday activities, and an exercise program. The exercise program was progressive and consisted of active range of motion exercises for the shoulder, elbow, wrist and hand, soft tissue stretches, isometric stabilising wrist exercises and, from Week 3, gentle forearm/wrist/hand strengthening exercises (including grip exercises). After instruction in the exercises, participants were asked to demonstrate them to the physiotherapist. In an effort to maximise compliance, participants were provided with a booklet outlining this advice and illustrating these exercises, and were instructed to continue this program at home. For the purposes of swelling control and comfort, participants were also fitted with an elastic threaded cotton sleeve[a] for the wrist and forearm and instructed in its application and precautions. Finally, experimental group participants were provided with the physiotherapist's contact details enabling them to seek clarification of their management, reassurance, or formal review as necessary.

Table 1. Thumb motion scale.

Score	Opposition of thumb tip to
1	Tip of index finger
2	Tip of middle finger
3	Tip of ring finger
4	Tip of little finger
5	Volar surface of the distal IP joint of the little finger
6	Volar surface of the proximal IP joint of the little finger
7	Volar surface of the MCP joint of the little finger
8	Distal palmar crease
9	Mid palmar crease

IP = interphalangeal, MCP = metacarpophalangeal. Based on the scale described by Kapandji (1992) and modified by Michael Sandow, Royal Adelaide Hospital.

The control group received no physiotherapy intervention.

Outcome measures

The primary outcome was wrist extension. Secondary outcomes were the other ranges of motion of the wrist joint and forearm (flexion, radial deviation, ulnar deviation, pronation, supination) and thumb (web-space), pain, and activity limitations. Range of motion was measured using a goniometer in positions recommended by the American Society of Hand Therapists (Adams et al 1992). Thumb opposition was measured using a thumb motion scale (Table 1) and grip strength was measured in kilograms using a calibrated Jamar dynamometer[b] on Setting 2 to ensure maximal grip strength (Firrell 1996) and with the elbow flexed to 90 deg. The Patient-Rated Wrist Evaluation is a 15-item questionnaire originally developed for patients with wrist pathology (MacDermid 1996). It rates wrist-related pain and activity limitations (ranging from 0 = no pain or no difficulty with the activity, to 10 = severe pain or unable to perform the activity). It has five pain-related questions and 10 activity-specific questions (MacDermid 1996). It has been shown to be a sensitive, valid, and reliable wrist assessment tool (MacDermid 1996) and has been used in studies of patients with distal radius fractures (MacDermid et al 2001). The *Quick*DASH takes only a few minutes to complete and is used to measure disability for patients with upper extremity musculoskeletal disorders. It has an 11-item section that measures overall upper limb disability and pain, and two optional sections pertaining to the ability to work (4 items) and participate in sports/performing arts (4 items). Every item has five possible responses (ranging from 1 = no difficulty to 5 = unable to perform) and the sum of responses is transformed to a score of 0 to 100 for each section, with a higher score indicating greater disability. The full DASH and *Quick*DASH questionnaires have been shown to have good psychometric properties (Beaton et al 2001, Gummesson et al 2006).

At the completion of the study, participants in both groups were asked to rate and comment on their satisfaction

Table 2. Baseline characteristics of participants.

Characteristic	Experimental group (n = 28)	Control group (n = 28)
Sex, n males (%)	8 (29)	9 (32)
Age *(yr)*, mean (SD)	55.0 (20.3)	55.8 (19.9)
Dominance, n (%)		
Right	26 (93)	26 (93)
Left	2 (7)	1 (4)
Ambidextrous	0 (0)	1 (4)
Mechanism of fracture, n (%)		
Fall from level	17 (61)	16 (57)
Fall from height or medium speed injury	9 (32)	10 (36)
Other	2 (7)	2 (7)
Side of fracture, n dominant (%)	11 (39)	16 (57)
Type of fracture, n (%)		
Extra articular	14 (50)	9 (32)
Partial articular	5 (18)	9 (32)
Complete articular	9 (32)	10 (36)
Type of fixation, n (%)		
Cast	20 (71)	21 (75)
Pins & cast	8 (29)	7 (25)
Period of immobilisation *(wk)*, mean (SD)	5.9 (0.4)	6.1 (0.9)
Time from injury to initial assessment *(wk)*, mean (SD)	6.1 (0.5)	6.4 (1.0)
Time from cast removal to baseline assessment *(d)*, mean (SD)	1.3 (2.3)	1.7 (2.5)

with their management using a purpose-designed form. Options for rating satisfaction with the amount and type of physiotherapy intervention were: too much, just right, too little. Experimental participants also rated their compliance with their home exercise regimen with options ranging from hourly to no exercise at all. All participants were given the option of receiving physiotherapy intervention after the study period and the number requesting this was documented.

Data analysis

A sample size of 24 participants per group was calculated[c] as being required, based on a Type 1 error of 0.05, a Type 2 error of 0.20 (statistical power of 80%), a standard deviation of 12 deg (wrist extension; Kay et al 2000, Taylor and Bennell 1994), and considering a difference of 10 deg (wrist extension, 55 deg vs 45 deg; Taylor and Bennell 1994) at Week 6 to be clinically significant.

Nominal and interval data from the patient profiles were analysed using the chi-square test and independent samples t-test respectively. The main outcomes were analysed using random or fixed effects mixed longitudinal models[d]. The Hausman test was used to check whether there was any serial correlation between unobserved effect and the observed variables. If it was rejected, the fixed effects estimate was reported. Interaction terms were used in all models to check whether the rate of change for the measured outcome over time was different between groups. If ordinal data failed a test for normal distribution, analyses were performed using variance-weighted least-squares regression. Participants' ratings of satisfaction with their management and the number of participants requesting ongoing physiotherapy treatment were compared between groups using the chi-square test. Analyses were performed on an intention-to-treat basis. Probability values of less than 0.05 were considered significant.

Prior to the commencement of the study, the physiotherapist assessor completed a full assessment of the physiotherapist-rated outcomes for 10 patients recovering from wrist pathology. Patients were re-assessed later on the same day in a different order with the assessor unaware of the original results. For the range of motion measurements and grip strength, Pearson's correlation coefficients ranged from 0.91 to 0.99, indicating good reliability (Portney and Watkins 2000). There were no significant differences in means between the two measurement occasions for most outcomes ($p > 0.12$, paired samples t-test), except for wrist flexion (mean difference 3 deg) and grip strength (mean difference 1.5 kg, $p < 0.02$).

Results

Flow of participants, therapists and centres through the trial

There were 56 participants, one therapist, and one centre in this study. From March 2006 to October 2007, 56 patients were randomly allocated to the experimental or control groups. The baseline characteristics of each group were similar (Table 2) and not statistically different. Retired or home duties were the most common occupations, reported by 14 (50%) experimental and 16 (57%) control participants ($p = 0.67$). Complications associated with the wrist fracture were reported by 13 (46%) experimental and 14 (50%) control participants ($p = 0.79$), and 24 (89%) of these 27 complications were apparent at the time of the initial measurement. The most common complications were finger stiffness/swelling apparent in 15 participants (27% of total sample), and shoulder/neck pain and stiffness apparent in nine participants (16% of total sample). Participants who experienced complications were not withdrawn from the study; they received their allocated intervention and were included in analyses. The flow of participants through the trial is shown in Figure 1. Eight (14%) participants failed to

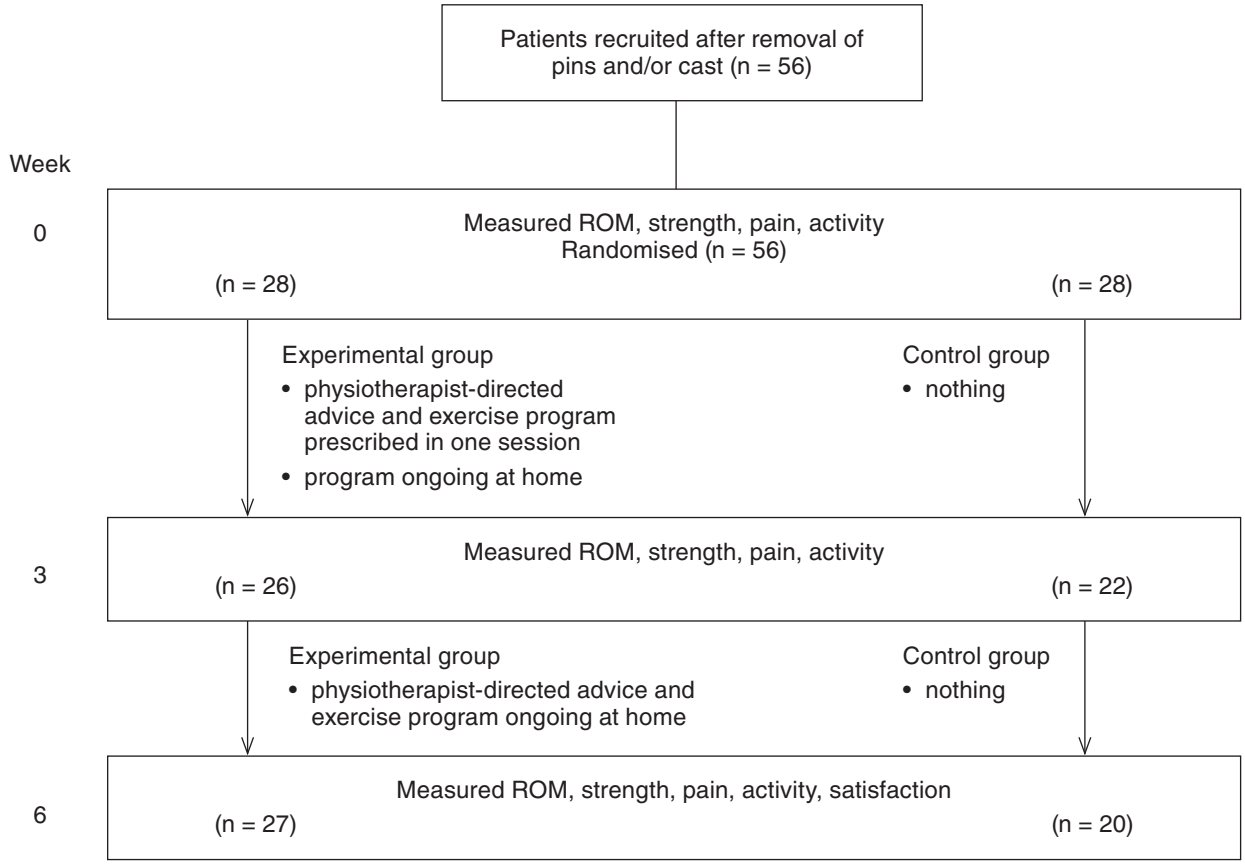

Figure 1. Design and flow of participants through the study.

attend for measurement at Week 3 and nine (16%) at Week 6, giving a retention rate of 86% and 84% respectively. The difference in attendance between the experimental and control group was not significantly different at Week 3 ($p = 0.13$) but significantly more control participants failed to attend for measurement at Week 6 ($p = 0.01$).

The therapist involved in providing care was a hand physiotherapist with a postgraduate qualification and 25 years' clinical experience in hand therapy. The centre involved in the study was an outpatient clinic at the Royal Adelaide Hospital which is a tertiary level hospital managing approximately 240 patients per year with distal radius fracture.

Compliance with trial method

Examination of the compliance questionnaires by experimental participants revealed that 20 (71%) performed their exercises more than once a day but not hourly, and 4 (14%) performed their exercises once per day. The other three categories of compliance (ie, hourly, 2–3 times a week, once every couple of weeks) were reported by one (4%) participant each. The remaining participant did not attend for the Week 6 measurement.

Effect of intervention

Group data for the three measurement occasions are presented in Table 3 while individual data can be found in Table 4 (see eAddenda for Table 4). For both groups combined, all outcomes were significantly improved ($p < 0.03$) by Week 3 and 6 compared to baseline, with the exception of the *Quick*DASH scores and Patient-Rated Wrist Evaluation (pain). For these latter measures, scores at Week 3 for *Quick*DASH (general), *Quick*DASH (work), and Patient-Rated Wrist Evaluation (pain) scores were not significantly different from baseline ($p > 0.20$) but did achieve significance by Week 6 ($p < 0.001$). *Quick*DASH (sports/performing arts) showed no significant change from baseline at either Week 3 or 6 ($p > 0.09$).

The difference between groups for the primary outcome, wrist extension, was 5 deg (95% CI –1 to 11, $p = 0.09$) at Week 3, and 6 deg (95% CI –3 to 14, $p = 0.09$) at Week 6 in favour of the experimental group, trending toward significance. The only statistically-significant differences between groups were for pain and activity limitations. The difference between groups for *Quick*DASH (general) at Week 3 was –13 points out of 100 (95% CI –24 to –2, $p = 0.008$) in favour of the experimental group. The difference between groups for Patient-Rated Wrist Evaluation (pain) was –16 points out of 100 (95% CI –27 to –5, $p = 0.06$) at Week 3 and –14 points (95% CI –25 to –3, $p = 0.03$) points at Week 6, in favour of the experimental group. Other trends were in range of motion and activity limitations. The difference between groups for web-space range of motion was –3 deg (95% CI –7 to 0, $p = 0.05$) at Week 6 in favour of the control group, and Patient-Rated Wrist Evaluation (function) was –14 points out of 100 (95% CI –29 to 1, $p = 0.09$) at Week 3 in favour of the experimental group.

There was a significant difference between groups for participants' satisfaction with their physiotherapy intervention ($p = 0.03$), with the amount of therapy perceived as being 'too much' by one participant (4%) in each group, 'just right' by 23 (82%) experimental participants compared with 10 (36%) control participants, and 'too

Table 3. Mean (SD) of all outcomes for each group, mean (SD) change within groups, and mean (95% CI) difference between groups.

Outcome	Groups						Difference within groups				Difference between groups	
	Week 0		Week 3		Week 6		Week 3 minus Week 0		Week 6 minus Week 0		Week 3 minus Week 0	Week 6 minus Week 0
	Exp (n = 28)	Con (n = 28)	Exp (n = 26)	Con (n = 22)	Exp (n = 27)	Con (n = 20)	Exp	Con	Exp	Con	Exp minus Con	Exp minus Con
Range of motion (deg)												
Extension	30 (18)	41 (14)	51 (15)	56 (10)	55 (17)	60 (9)	21 (12)	16 (9)	26 (18)	21 (9)	5 (–1 to 11)	6 (–3 to 14)
Flexion	31 (11)	30 (15)	42 (11)	40 (14)	47 (12)	45 (11)	13 (13)	13 (9)	17 (12)	19 (10)	0 (–6 to 7)	–1 (–7 to 5)
Radial deviation	7 (6)	7 (5)	12 (5)	11 (3)	13 (5)	12 (4)	5 (5)	5 (5)	6 (6)	6 (5)	0 (–3 to 3)	0 (–3 to 3)
Ulnar deviation	11 (6)	13 (5)	15 (5)	17 (4)	17 (6)	18 (4)	5 (5)	5 (5)	7 (6)	6 (5)	0 (–3 to 3)	1 (–2 to 4)
Pronation	56 (17)	63 (14)	65 (10)	73 (8)	68 (9)	73 (7)	9 (12)	11 (8)	12 (14)	10 (11)	–2 (–7 to 4)	2 (–5 to 9)
Supination	52 (25)	58 (21)	64 (15)	65 (12)	66 (14)	68 (11)	13 (16)	11 (13)	15 (20)	13 (12)	2 (–7 to 10)	2 (–8 to 12)
Web-space	43 (7)	44 (9)	45 (7)	47 (9)	46 (7)	49 (7)	3 (5)	4 (7)	3 (6)	7 (7)	–1 (–5 to 2)	–3 (–7 to 0.4)
Thumb motion scale *(1 to 9)**	6 (4 to 7)	7 (5 to 7)	7 (6 to 7)	7 (6 to 8)	7 (7 to 7)	8 (7 to 8)	1 (2)	1 (1)	1 (2)	1 (1)	0 (–1 to 1)	0 (–1 to 1)
Grip strength *(kg)*	7.4 (10.8)	10.3 (12.8)	14.5 (13.3)	13.9 (13.7)	17.6 (14.1)	15.5 (11.1)	7.0 (7.1)	5.9 (4.7)	10.2 (8.0)	8.5 (4.9)	1.4 (–2.2 to 4.9)	2.3 (–1.7 to 6.3)
PRWE (pain) *(0 to 100)*	50 (26)	49 (24)	31 (21)	49 (25)	23 (21)	37 (23)	–19 (20)	–5 (18)	–26 (20)	–13 (18)	–16 (–27 to –5)	–14 (–25 to –3)
PRWE (function) *(0 to 100)*	69 (25)	66 (27)	34 (25)	48 (27)	21 (23)	31 (23)	–33 (25)	–23 (28)	–47 (24)	–46 (19)	–14 (–29 to 1)	–7 (–20 to 7)
*Quick*DASH (general) *(0 to 100)*	52 (19)	50 (21)	35 (21)	48 (21)	25 (21)	32 (18)	–16 (18)	–5 (21)	–27 (17)	–22 (17)	–13 (–24 to–2)	–6 (–16 to 4)
*Quick*DASH (work) *(0 to 100)*	63 (26)	59 (30)	33 (29)	46 (29)	19 (25)	26 (21)	–32 (28)	–26 (23)	–44 (30)	–42 (25)	–12 (–31 to 7)	–8 (–28 to 11)
*Quick*DASH (sports/ performing arts) *(0 to 100)*	79 (28)	70 (31)	48 (39)	52 (38)	29 (31)	39 (40)	–35 (36)	–25 (36)	–49 (39)	–32 (39)	–11 (–43 to 21)	–19 (–54 to 17)

Shaded row = primary outcome; * = median (IQR); Exp = experimental group, Con = control group, *Quick*DASH = shortened version of the Disabilities of the Arm, Shoulder and Hand questionnaire, PRWE = Patient-Rated Wrist Evaluation

little' by nine (32%) control participants compared with three (11%) experimental participants. A total of 41 (73%) participants, 24 (86%) experimental and 17 (61%) control, commented on their physiotherapy intervention. Of the control participants, 13 (46%) commented on their concern at the lack of advice/direction/follow-up, while 20 (71%) experimental participants commented on their appreciation of this advice/direction/follow-up.

There was no significant difference between groups (p = 0.12) in the number of participants requesting physiotherapy intervention after the study period, with six (21%) experimental participants and 10 (36%) control participants requesting further intervention.

Discussion

This study investigated whether an advice and exercise program provided by a physiotherapist improved the outcome of patients after wrist fracture managed with pins and/or cast, when compared to that achieved with natural recovery alone. All measurements of range of motion, strength, pain, and activity limitations improved significantly over the six week period with the exception of *Quick*DASH (sports/performing arts). While there were no significant differences between groups for the primary outcome of wrist extension, or for the secondary outcomes of other wrist ranges of motion and grip strength, there were significant benefits for the experimental group in activity at Week 3 (*Quick*DASH general) and pain at Week 3 and 6 (Patient-Rated Wrist Evaluation pain). The experimental group were also significantly more satisfied with the amount of physiotherapy intervention. Our results confirm that most patients who have sustained a fracture of the distal radius show improvement over time in range of motion, grip strength, pain, and activity and the magnitude of improvement in these outcomes was comparable to previous research (Kay et al 2000, Maciel et al 2005, Taylor and Bennell 1994, Watt et al 2000).

Our sample appeared representative of those who usually present with this type of injury (Kay et al 2000, Maciel et al 2005, Taylor and Bennell 1994, Wilcke et al 2007). We chose to include those patients whose fracture was managed with pins and/or cast, as this is the standard management for less severe/complicated wrist fractures, but made no attempt to select patients within this group who were likely to have good outcomes. We selected an advice and exercise program as the intervention for the experimental group since exercises are the most frequent intervention for this patient group (Michlovitz et al 2001) and in view of the lack of proven effectiveness of other interventions. In terms of outcome measures, we consider that the combination of motor impairments and patients' perception of their own disability provided an appropriate reflection of recovery. However, the optional component of *Quick*DASH (sports/performing arts) showed no significant change over time, which may reflect that 32 (57%) participants did not play sport or participate in a performing art.

A limitation of our study was the number of control participants who did not return for measurements at Week 3 and 6, despite repeated attempts to contact them. We were unable to ascertain the reasons for non-attendance and, clearly, we were also unable to determine whether these participants responded in a similar fashion to other control participants, and the extent to which this influenced our results. It is possible that our results may have been more favourable towards the experimental group, in terms of range of motion and grip strength, if more control participants had returned for measurements at Week 3 and 6. A further limitation is that while a blinded assessor was used for the therapist-rated outcomes, participants were aware whether they received intervention or not and therefore were not blinded, introducing a potential source of bias.

Are the results of our study clinically important? It has been noted that traditional assessment of outcome after intervention for fractures of the distal radius, using measures such as wrist range of motion and grip strength, may not reflect outcomes that are important to the patient and furthermore do not necessarily correlate with level of activity (Karnezis and Fragkiadakis 2002). We found no significant differences between groups for range of motion and grip strength and the 95% confidence intervals for these data do not suggest a clinically-worthwhile effect. While the reason for our failure to detect differences between groups for range of motion is not clear, it is possible that grip strength did not show a between-group difference because strengthening exercises were introduced only at Week 3 for the experimental group (in view of pain and fracture healing) and their progression was not monitored. Also, as noted earlier, the higher rate of non-attendees from the control group at Weeks 3 and 6 may have influenced our results. However, we found significant benefits for the experimental group for some of the secondary outcomes, namely activity at Week 3, pain at Weeks 3 and 6, and satisfaction with the amount of physiotherapy intervention at Week 6. The 95% confidence intervals for these data span a range from around zero to a clinically-worthwhile effect. There appear to be no published data concerning the minimal clinically-important difference for *Quick*DASH or the Patient-Rated Wrist Evaluation. However, we believe the significantly better outcomes for the experimental group for activity, pain, and satisfaction with management are clinically important. Indeed, based on our results, we recommend that future studies with similar patient groups should consider using activity limitations or pain as the primary outcome, rather than wrist extension range of motion.

An important additional finding was that the assessment of patients (by virtue of their involvement in our study) led directly to the detection of complications arising from their wrist fracture or fracture management. Arguably, many of these complications may have been overlooked or have had delayed diagnosis if it were not for the study protocol. Thus, our impression is that review of patients at the time of, or near to, cast removal and again a few weeks later, provides physiotherapists with an opportunity to detect complications.

Further research should be undertaken with similar patient groups to confirm our results and increase the generalisability of our findings, particularly given that our sample was taken from a single tertiary-level hospital and only one therapist provided treatment for the experimental group. Additionally, studies involving patients with more severe wrist fractures managed with open reduction and internal fixation, or external fixation, could be undertaken to investigate the effectiveness of physiotherapy for these other groups.

In conclusion, this study found that a physiotherapist-directed program of advice and exercises resulted in

significant benefits in activity, pain, and satisfaction over natural recovery alone for patients following fractures involving the distal radius managed with pins and/or cast. Based on these results, we recommend that patients should be routinely referred to a physiotherapist for instruction in an advice and exercise program and to allow early detection of complications.

Footnotes: [a]Tubigrip, Medlock Medical, UK. [b]JA Preston Corporation, Jackson, MI, USA. [c]STPLAN version 4, B Brown, University of Texas. [d]StataCorp. 2003; Stata Statistical Software: Release 8.0, College Station Texas: Stata Corporation.

eAddenda: Table 4 available at AJP.physiotherapy.asn.au

Ethics: The Royal Adelaide Hospital Research Ethics Committee approved this study. Informed consent was gained from all participants before data collection began.

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