EDITOR'S CHOICE

A Prospective Randomized Trial Comparing the Functional Results of Buddy Taping Versus Closed Reduction and Cast Immobilization in Patients With Fifth Metacarpal Neck Fractures

Natalia Martínez-Catalán, MD,* Samuel Pajares, MD,* Lucia Llanos, MD, PhD,† Ignacio Mahillo, MSc, PhD,‡ Emilio Calvo, MD, PhD*

Purpose Although fifth metacarpal neck fractures are typically treated nonsurgically, most often with closed reduction and orthosis immobilization, cast immobilization may not improve outcomes compared with buddy taping without reduction. The aim of this study was to compare functional outcomes of buddy taping versus reduction and cast immobilization in patients with fifth metacarpal neck fractures.

Methods Adult patients with acute fifth metacarpal neck fractures with less than 70o volar angulation and without rotational deformity were randomly assigned to be treated either with buddy taping or a cast after closed reduction. The primary outcome was the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire score at 9 weeks. Secondary outcomes included the DASH score at 3 weeks and 1 year, range of motion of the metacarpophalangeal joint, pain, grip strength, return to work, radiographic angulation, and complication rate.

Results We recruited 72 patients between August 2016 and January 2018. After 3 weeks, the DASH score was significantly lower for patients treated with buddy taping (19.7 ± 19.7) compared with cast immobilization (44.6 ± 15.0). At 9 weeks, clinical outcomes in the buddy taping group were better in terms of range of motion and DASH score, with a mean difference of 6.3 points, which did not exceed the minimally clinically important difference. There were more complications in the cast immobilization group. Fracture angulation after reduction was followed by a loss of reduction at 3 weeks' follow-up and equivalent residual radiographic volar angulation was observed at 3 and 9 weeks after injury in both groups. Duration of time off from work was 28 days shorter with buddy taping compared with cast treatment.

Conclusions There is no benefit to reduction and orthosis immobilization of fifth metacarpal neck fractures with an initial angulation less than 70°. Use of buddy taping and early mobilization had good clinical results as well as significant improvement in time lost from work. *(J Hand Surg Am. 2020;45(12):1134–1140. Copyright © 2020 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic I.

Key words Buddy taping, cast immobilization, clinical trial, fifth metacarpal neck fracture, randomized.

*From the *Department of Orthopaedic Surgery and Traumatology, the †Clinical Research Unit, and the ‡Department of Statistics, Hospital Universitario Fundación Jiménez Diaz, FJD Health Research Institute, Madrid, Spain.*

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Corresponding author: Natalia Martínez-Catalán, MD, Department of Orthopaedic Surgery and Traumatology, Hospital Universitario Fundación Jiménez Diaz, Universidad Autónoma, Avda. Reyes Católicos, 2, 28040 Madrid, Spain; e-mail: natalia.martinezcat@gmail.com.

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THE SUBCAPITAL FRACTURE of the fifth metacarpal bone represents approximately 20% of all hand fractures, especially in the working-age population. Although these fractures are typically treated nonsurgically, the ideal treatment, time of immobilization, need for reduction, and maximum acceptable amount of fracture angulation remain controversial.

Traditionally, these fractures have been treated with closed reduction and orthosis immobilization,[1–3] with the rationale that this approach provides more anatomic alignment and improves outcomes. This treatment is offered to these patients in most emergency departments. However, the reason for immobilization has much more to do with addressing pain and ensuring that the hand remains in an appropriate position for subsequent rehabilitation than with holding a reduction, because immobilization after reduction does not seem to change the final position of the fracture.[4] In addition, cast immobilization may prevent an individual from working for a longer period[4] and may slow functional recovery.

For fifth metacarpal neck fractures with less than 70° apex dorsal angulation and without a rotational deformity, the best available evidence suggests that buddy taping of the fourth and fifth digits without reduction yields results equivalent to closed reduction and orthosis treatment.[4–14]

The proposed limit of fracture angulation to minimize functional deficit has been assumed to be 30°, but it has been demonstrated that the degree of angulation for closed fifth metacarpal neck fractures may not correlate with outcome and functional results.[12,13] Several studies described that mobility of the fifth carpometacarpal joint accommodates up to 70° of volar angulation.

We hypothesized that closed reduction and immobilization obtains similar clinical results as buddy taping, but may slow functional recovery. The main purpose of this study was to compare the functional outcomes of buddy taping in patients with fifth metacarpal neck fractures with volar angulation less than 70° and no rotational deformity with treatment of this fracture with closed reduction and cast immobilization, at 3 weeks, 9 weeks, and 1 year.

MATERIALS AND METHODS

Male and female adult patients presenting to the emergency service of our institution with acute (less than 72 hours) fifth metacarpal neck fractures were eligible to be included in the study. Exclusion criteria were comminuted neck fractures, more than 70° volar angulation, rotational deformity, previous fifth metacarpal fracture, open fractures, concomitant fractures of the ipsilateral extremity, concomitant tendon injuries, patients with multiple injuries, and those unwilling to participate or unable to adhere to a minimum of 9 weeks' follow-up.

Study design

We performed a prospective, unmasked, controlled, randomized clinical trial. Once confirmed that they were eligible to participate, patients were randomly assigned (allocation ratio of 1:1) to one of the following treatment groups: Group 1 had buddy taping of the fourth and fifth metacarpals for 3 weeks without reduction of the fracture, and wrist and fingers allowed immediate mobilization. Group 2 had closed reduction of the fracture using the Jahss maneuver[15] and immobilization in an ulnar cast from the proximal interphalangeal (PIP) joint to the forearm with the digits in the intrinsic-plus position (wrist in 45° extension, metacarpal joints in 90° flexion, and interphalangeal joints in full extension), which has been described in the literature as the position of safety.[5–9] After reduction and cast placement, anteroposterior and 45° pronated-oblique radiographs were obtained to assess fracture angulation after reduction.

Randomization was performed according to a computer-generated sequence provided by the Fundación Jiménez Diaz Statistics Unit. Allocation concealment was not performed. Blinding of treatment allocation was not possible owing to the nature of the interventions.

This study was approved by the local ethics committee before patient enrolment. All patients gave written informed consent to participate in the trial. The study was registered in www.clinicaltrials.gov (Identifier: NCT03434587).

Study procedures

Patients went through a screening and treatment visit and 2 in-person follow-up visits at 3 and 9 weeks. During the screening period, clinical history, x-rays with angulation measurements, and a pain evaluation by a visual analog scale (VAS) (in centimiters, in which 0 = no pain and 10 = maximum pain) were performed. In subsequent visits, Disabilities of the Arm, Shoulder, and Hand (DASH) score, range of motion (ROM), grip strength, duration of sick leave from work, and complications were also recorded. A phone call evaluation was performed at 12 months from treatment to record DASH score and complications and to confirm time of sick leave from work.

TABLE 1. Patients' Demographics

Variables	Group 1 (n = 34)	Group 2 (n = 38)
Age, y (mean ± SD)	41 ± 19	44 ± 27
Male, n (%)	28 (82)	29 (76)
Dominant affected hand, n (%)		
No	8 (23)	9 (24)
Yes	26 (76)	29 (76)
Employment status, n (%)		
Working	14 (45)	16 (47)
Not working	17 (55)	18 (53)
Pain VAS baseline, cm	4.55 ± 1.89	3.94 ± 1.65
Fracture angle (degrees) (mean ± SD)	40 ± 12	39 ± 13

Anteroposterior and 45o pronated-oblique radiographs were obtained at recruitment into the study after fracture reduction in the emergency department, if performed, and at the 3- and 9-week visits. Fracture angulation was measured by the angle between the subcapital axis and the full-shaft axis, also known as subcapital axis angle.[10,16] All angulation measurements were taken by the same researcher (N.M.C.).

Range of motion of the metacarpophalangeal joint was measured using a goniometer applied on the dorsal aspect of the MCP joint. Complete ROM of the MCP joint was considered to be 15° extension and 90° flexion. Active MCP flexion and extension of the fifth metacarpal were not measured on the contralateral side.

Grip strength was determined with a dynamometer, comparing results obtained in the injured hand with respect to strength registered on the contralateral side. Considering complete grip strength to be the measure of the uninjured side, we determined how many patients had complete grip strength at 3 and 9 weeks of follow-up.

Study end points

The primary end point of the study was the DASH score at 9 weeks from the intervention. Secondary end points included the DASH score at 3 weeks and 12 months from treatment, time for return to work, final angulation at the fracture site, grip strength, ROM, and VAS score at 3 and 9 weeks, and complication rate in both groups 12 months after treatment.

Statistical considerations

Sample size calculation: We based the sample size on the number of potential participants who were admitted to the emergency department at our center and planned to include 30 patients/treatment group, with a total of 72 patients (36/group) considering a 20% dropout rate. With this sample size, the study would have a statistical power of 86% to detect a difference between groups of 10.8 points for the DASH (minimal clinically significant difference),[17,18] assuming an SD of 15 points.

Statistical analysis: First, we carried out a descriptive analysis of baseline characteristics of the included patients. Continuous variables are expressed as mean and SD. Categorical variables are expressed as counts and percentages. We calculated 95% confidence intervals (CIs). Kolmogorov-Smirnov test was used to assess the normality of the continuous variables. Mean DASH score at 9 weeks for both groups was compared with the Student *t* test. For the analysis of the secondary objectives, relevant tests were carried out according to the type of variable: analysis of categorical variables was performed with the chi-square test with Yates correction or the Fisher exact test. For continuous variables, parametric (*t* test) or nonparametric (Mann-Whitney U) test was used, depending on the applicability. The level of significance was set at $P < .05$.

RESULTS

A total of 78 adult patients presenting to the emergency service with acute fifth metacarpal neck fracture were recruited between August 2016 and January 2018. After we obtained informed consent and checked their eligibility, we randomly assigned them to group 1 (buddy taping, n = 36; 46%) or group 2 (closed reduction and cast immobilization, n = 42; 54%). Two patients in group 1 and 4 in group 2 withdrew from the study early after randomization. A

TABLE 2. Results at 3 Wk Follow-Up

Variables	Group 1 (n = 34)	Group 2 (n = 38)	Difference (95% CI)	*P* Value
DASH (mean ± SD)	19.7 ± 19.7	44.6 ± 15	24.8 (16.3−33.3)	<.05
VAS, cm (mean ± SD)	1.48 ± 1.20	3.24 ± 1.72	1.75 (1.03−2.48)	<.05
Flexion of fifth MCP joint (degrees) (mean ± SD)	81 ± 13	55 ± 21	−26 (−34 to 17)	<.05
Extension of fifth MCP joint (degrees) (mean ± SD)	5 ± 10	−5 ± 15	−9 (−16 to 3)	<.05
Fifth MCP abduction (degrees) (mean ± SD)	25 ± 8	15 ± 9	−10 (−14 to 6)	<.05
Power grip, n (%)				<.05
Complete	12 (36.4)	0	−36 (−56 to 17)	
Incomplete	21 (63.6)	33 (100)		
Fracture angle (degrees) (mean ± SD)	38 ± 12	35 ± 9	−3 (−0.1 to 2)	

total of 72 patients completed the study: 34 in group 1 (47%) and 38 in group 2 (53%). Table 1 lists baseline characteristics of patients included in the study.

At 3 weeks, the DASH score was significantly lower in the buddy taping group compared with the cast immobilization group (19.7 ± 19.7 and 44.6 ± 15.0, respectively; mean difference, 24.8; 95% CI, 16.3−33.3; $P < .05$). Pain measured by VAS was significantly lower in group 1 (1.5 ± 1.2 vs 3.2 ± 1.7; $P < .05$). Range of motion of the fifth MCP joint was also significantly better in group 1 (Table 2).

Table 3 shows absolute values, differences, and 95% CIs for outcomes at 9 weeks' follow-up. There was a statistically significant difference in DASH scores between groups (group 1: 8.44 ± 14.0; group 2: 2.13 ± 7.97; mean difference, 6.31; 95% CI, 0.58−12.0; $P = .05$), but this was less than the minimally clinically important difference.[17,18]

In group 2, improvement was reported in fracture displacement with the reduction performed (27° ± 12°) compared with fracture angulation before reduction (39° ± 13°) (mean difference, 15° ± 9°; $P < .05$), as well compared with the group that did not undergo reduction (40° ± 12°; $P < .05$). However, fracture angulation after reduction was followed by a loss of reduction at 3 weeks' follow-up (35° ± 9°; mean difference in volar fracture angulation, 10° ± 9°, $P < .05$). Equivalent residual radiographic volar angulation was observed at 3 and 9 weeks after injury in both groups, and we did not observe changes in fracture angle progression between group 1 (38° ± 12° at 3 weeks and 38° ± 12° at 9 weeks) and group 2 (35° ± 9° at 3 weeks and 36° ± 9° at 9 weeks) (Table 3).

Patients in group 1 reported a shorter absence from work compared with patients in group 2 (mean difference, 29 days; 95% CI, 15.7−41.4). After 1-year follow-up, we found no differences between groups regarding DASH score (mean difference, 0.32; 95% CI, −0.36 to 1.01).

The complication rate was lower in group 1 compared with in group 2 at both 3 and 9 weeks after treatment (mean difference at 3 weeks, 19.5%: 95% CI, −1.4 to 40.3; and mean difference at 9 weeks, 21.2%: 95% CI, 0.9−41.6).

The most common complications were MCP and PIP joint stiffness, observed in 9 patients treated with closed reduction and cast immobilization and 2 patients with buddy taping (Table 4).

DISCUSSION

Management of fifth metacarpal neck fractures remains controversial. Despite evidence in the literature showing that buddy taping the fourth and fifth digits without reduction yields results equivalent to closed reduction and immobilization,[11] fracture manipulation is still the method of choice in many hospitals based on the belief that immobilization might help by alleviating pain associated with the fracture and ensuring that the hand remains in an appropriate position for subsequent rehabilitation. Our trial demonstrates better short-term outcomes with buddy taping compared with traditional treatment with closed reduction and cast immobilization. Differences between treatment groups are greatest in the first 3 weeks, showing that recovery time seems to be shorter with the use of buddy taping.

Bansal and Craigen[14] compared 40 patients with fifth metacarpal neck fractures managed in plaster

TABLE 3. Results at 9 Wk Follow-Up

Variables	Group 1 (n = 34)	Group 2 (n = 38)	Difference (95% CI)	*P* Value
DASH (mean ± SD)	2.13 ± 7.97	8.44 ± 14.0	6.31 (0.58−12.0)	<.05
VAS, cm (mean ± SD)	0.27 ± 0.63	0.97 ± 1.56	0.70 (0.10−1.29)	<.05
Flexion of fifth MCP joint (degrees) (mean ± SD)	90 ± 4	81 ± 14	−8 (−14 to −3)	<.05
Extension of fifth MCP joint (degrees) (mean ± SD)	11 ± 4	9 ± 7	−2 (−5 to −.1)	>.05
Fifth MCP abduction (degrees) (mean ± SD)	28 ± 5	24 ± 8	−4 (−8 to −1)	<.05
Power grip, n (%)				.789
Complete	24 (72.7)	22 (66.7)	−6.1 (−31.2 to 19.1)	
Incomplete	9 (27.3)	11 (33.3)		
Fracture angle (degrees) (mean ± SD)	38 ± 12	36 ± 9	−2 (−8 to 3)	
Work leave, d (mean ± SD)	8 ± 14	37 ± 22	29 (16−41)	<.05

TABLE 4. Complications

Variables	Group 1 (n = 34)	Group 2 (n = 38)	Difference (95% CI)	*P* Value
3-wk follow-up, n (%)	3 (9.1)	10 (28.6)	19.5 (−1.4 to 40.3)	>.05
9-wk follow-up, n (%)	2 (6.1)	9 (27.3)	21.2 (0.9−41.6)	<.05

and 38 patients treated with neighbor strapping and obtained equivalent DASH scores in both groups at 12 weeks. Van Aaken et al[4] published a prospective, randomized trial of 64 patients in which 37 were treated with soft wrapping and 27 with closed reduction and orthosis immobilization. The primary outcome measured in that study was the *Quick*DASH score at 4 months from treatment. They did not find significant differences in subjective and objective outcome parameters, which confirms the results of previous studies that also failed to find differences between treatment groups. The reason for these results might be that they compared the *Quick*DASH score at 4 months' follow-up. As we observed in the current study, at 9 weeks, mean DASH score differed by less than 10 points in both groups, which suggests that at 9 weeks' follow-up, patients in both groups were almost recovered. More interestingly, results obtained at 3 weeks with the use of buddy tapping suggested that this treatment seems to allow faster functional recovery. This is important because these fractures occur frequently in a working-age population and orthosis immobilization may have economic consequences owing to absences from work.[19] Our study confirmed significant improvement in time to return to work in the group managed with early mobilization, as previously reported.[4,14]

A review of current literature demonstrates no consensus regarding the maximum acceptable fracture angulation, the need for reduction, or the need for both clinical and radiographic follow-up.[11]

Koukkanen et al[9] conducted a prospective trial of 29 patients and concluded that reduction and orthosis immobilization did not improve fracture angulation from the initial injury. Van Aaken et al[4] demonstrated that after reduction, there was significant progression of fracture angulation and loss of reduction in patients immobilized with a cast. They accepted 45° volar angulation after reduction and considered residual angulation greater than 45° to necessitate repeat manipulation. However, in their study, persistence of residual angulation after 3 attempts of reduction was accepted as long as angulation was less than 70°. McMahon et al[7] found no difference in mean radiographic angulation between a group that underwent reduction and one that did not. Another study[20] of 200 patients with fifth metacarpal neck fracture demonstrated equivalent residual radiographic angulation at 4 weeks' follow-up in a group that underwent reduction and one that did not. In our study, fracture reduction was followed by a significant loss of reduction at 3 weeks' follow-up, which supports the conclusion that reduction does not change the final position of the fracture and the use of

immobilization is not necessary to hold a reduction and ensure healing.

The degree of volar angulation may not correlate with outcome.[10,12,13] Some studies concluded that treating a fifth metacarpal neck fracture with angulation of up to 75° by soft wrap and buddy taping had good clinical results.[10] We obtained equivalent residual radiographic volar angulation at 3 and 9 weeks after injury in patients who underwent closed reduction and in patients who did not; independent of final fracture angulation, at final follow-up, good functional outcomes were reported in both groups based on DASH score and ROM, which led us to conclude that reduction and immobilization of these fractures is unnecessary.

In addition, our findings support the notion that follow-up beyond 3 weeks seems to be unnecessary for uncomplicated fifth metacarpal neck fractures treated with buddy taping.

Regarding complications, few studies reported complications related to nonsurgical treatment of these fractures, such as skin necrosis after placement of an orthosis.[21] The most common complication observed in our study was MCP and PIP joint stiffness after cast immobilization.

Our study had limitations. First, although this trial was prospective and randomized, different orthopedic surgeons performed fracture reduction. Nevertheless, all patients were observed and radiographic angulation was measured by the same orthopedic surgeon (N.M.C.). In addition, perfect 45o pronated radiograph projections are difficult to obtain in every patient, and therefore, in some cases, values might have been underestimated or overestimated. Also, angulation measurements were performed only once and by the same researcher, and thus no interrater reliability could be assessed. Second, we assessed grip strength but did not perform a correction for limb dominance. Classically, it has been considered that the dominant hand is slightly stronger than the opposite nondominant one, but recent studies specifically focusing on hand grip strength have questioned this.[22] Finally, during recruitment, 10 patients refused to participate. This might have introduced bias; however, baseline characteristics were similar in both treatment groups.

Our study had also strengths to highlight. We completed at least 1 year of follow-up in every patient and we obtained results in terms of DASH score at short-term and long-term follow-up. Although at 1 year of follow-up we interviewed patients over the telephone rather than in the clinic, and grip strength or ROM could not be measured, based on good clinical outcomes at 9 weeks' follow-up and on previous studies suggesting that regular follow-up is unnecessary for uncomplicated fifth metacarpal neck fractures, we anticipated that satisfied patients might not return for assessment.

Our study shows that immediate mobilization in fifth metacarpal neck fractures offers better results at short-term follow-up, significantly shorter time lost from work, and a smaller complication rate. Good results have been described with both treatments with follow-up of as much as a year.

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