

Patient-reported outcome of fifth metacarpal neck fracture treated with buddy taping versus ulnar gutter cast

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Abstract

Background: Buddy taping (BT) and ulnar gutter cast (UGC) are commonly used for treatment of fractures of the neck of the 5th Metacarpal. This retrospective analysis aims to investigate if UGC is a superior treatment option regarding symptom improvement as reported by the patient using the shortened Disability of Arm, Shoulder and Hand (*QuickDASH*®) score. **Methods:** Forty-eight patients with uncomplicated fractures of the neck of the 5th metacarpal presented to our unit from July 2017 to June 2019. Patients received either BT or UGC depending on the treating surgeon. They filled out the *QuickDASH*® on presentation and only 39 returned a follow-up questionnaire in September 2019. A retrospective analysis of *QuickDASH*® scores at presentation and follow-up was conducted and the change to the score was recorded for each patient as the clinical difference (CD). Patients were stratified in two Groups according to their management. The primary outcome is to measure the CD against the minimally clinical important difference (MCID). **Results:** Twenty patients received BT and 19 had UGC. Both groups were normally distributed. No statistical difference was observed in the change between the initial and follow-up *QuickDASH*® scores between both cohorts. A significant positive correlation was found between both the initial *QuickDASH*® and the clinical difference (CD) and the follow up *QuickDASH*® and the Dorsal Apex Angle (DAA) ($p < 0.001$). **Conclusion:** The patient-reported outcomes show no significant difference between BT and UGC in treating 5th metacarpal neck fractures. However, BT may require fewer resources and fewer follow-up appointments, ultimately reducing the cost of treatment in a pressured health care service.

Keywords: 5th Metacarpal neck fractures, Buddy tapping, patient reported outcomes.

Introduction:

Fifth metacarpal neck fractures are one of the most frequent hand fractures representing up to 35% of all metacarpal fractures [1]. Males are commonly affected with a male to female ratio of 6:1, mostly in the 2nd to 3rd decade of life [2]. The incidence of the 5th metacarpal neck fractures in the United Kingdom (UK) population is estimated between 1800-2500 cases annually [3]. The mechanism of these fractures is usually due to a longitudinal compression force introduced on a closed fist, hence the synonym Boxer's fracture. This produces volar fracture angulation due to the contorting forces produced by the interossei. This invariably leads to loss of the knucklehead which is a common sign, shortening of the digit, and a dorsal apex angle (DAA) measured on the true lateral view [4,5].

Non-surgical measures are the mainstay of treatment of uncomplicated 5th metacarpal neck fractures [6,7]. These include fractures with less than 70 degrees DAA, less than 3mm shortening and no rotation or scissoring. The 2 major modalities buddy taping (BT) and ulnar gutter casting (UGC) have been described in the literature [6]. Buddy

taping by wrapping both the little and ring fingers together allow stabilisation of the 5th ray by using the 4th ray as a splint hence providing support while maintaining a degree of mobility. This method boasts the advantage of its ease of application and allows more hand function as it is not as obstructive as a cast but provides very minimal protection to the fractured hand [8,9].

Ulnar gutter casts envelopes the little and ring fingers in plaster on both their dorsal and volar aspects circling the ulnar border of the hand which provides superior immobilisation and protection of the fractured ray [10, 11]. However, the UGC is sometimes considered cumbersome as it is bulky, restricts mobilisation and requires an additional appointment for removal.

This retrospective analysis compares the outcomes of 5th metacarpal neck fractures treated with both treatment techniques from the patient's perspective by measuring the change in the patient-reported outcome measured during recovery. Treatment of these fractures with UGC is hypothesised to be superior to BT. The aim of this analysis is to examine the effectiveness of both treatments using

validated patient-reported outcomes. The primary outcome is the improvement in symptoms as detected by the clinical difference (CD) measured against the MCID which is set above 16.

Methods

Patient selection

Retrospective analysis of shortened Disability of Arm, Shoulder and Hand (QuickDASH®) score for patients from July 2017 to July 2019 suffering 5th metacarpal neck fractures. The patients were recruited, consented and asked to fill in the QuickDASH® score by the lead investigator in the plastic trauma clinic. All patients included had only closed fracture of the neck of the fifth metacarpal with no rotation or scissoring, with less than 3mm shortening and DAA less than or equal to 70 degrees as measured on radiographs on the true lateral view (12). Patients with scissoring or angulation, with more than 70-degree DAA and a shortening of more than 3mm who require Manipulation under Anaesthesia (MUA), or any other concomitant injuries were excluded. QuickDASH® 11-question questionnaire was given prospectively to 48 patients to fill on presentation. In September 2019, patients were followed up with telephone calls and emails for post-treatment QuickDASH® scores. Thirty-nine responses were received. The minimal clinically important difference (MCID) was set at 16 [13, 14] and both groups were compared for their respective change in the QuickDASH® score pre- and post-treatment to quantify improvement; the clinical difference (CD).

Treatment Cohorts

Patients who received treatment in form of buddy taping (BT) of the little and ring fingers and allowed for early active motion were recruited into Group A, while the patients treated in an ulnar gutter cast (UGC) for 3 weeks, with a repeat X-ray in one week were Group B. The choice of treatment depended on the treating surgeon's preference.

Ethical Approval

This work required no ethical approval from our institution as it did not involve any new methods of treatment, nor it used new commercialised material on patients.

Statistics

The data were normally distributed as per the Shapiro-Wilk test. All values are reported at mean with standard deviation unless stated otherwise. Continuous variables assessed using independent t-test to compare cohort outcomes following Levene's Test for Equality of Variances. Initial presentation of DAA and QuickDASH® scores of patients were compared to follow-up QuickDASH® using paired t-test. Categorical Values were analysed using Fisher's exact test. Correlations were performed using two-tailed Pearson's correlation test. Statistical significance is set at $p \leq 0.05$. All statistical

analyses were done using Prism® version 7 (GraphPad Software Inc., California, USA) and IBM SPSS® Statistics version 25 (IBM Corp, New York, USA).

Results

A total of 39 patients were enrolled in this study. Twenty patients were treated using buddy taping and early active mobilization while 19 patients' fractures were managed using an ulnar gutter cast. Patient age and gender were similar between both groups. In both groups, the mechanism of injury was due to "a punch". The mean follow up was 10 months in the BT group and 13 months in the UGC group. Injury characteristics including the degree of dorsal apex angulation of the neck of the 5th metacarpal fracture and initial QuickDASH® scores were similar between both cohorts. Follow-up measures including subsequent QuickDASH® score and the measured clinical difference remained similar between both groups. Patient demographics and outcomes are outlined in Table 1.

	Buddy Taping (n:20)	Ulnar Gutter (n:19)	p value
Age	19 (±3)	21 (±5)	0.086
Gender (M/F)	17/3	16/3	1
Time from Injury (Months)	13 (±4)	10 (±4)	0.045
Degree of Dorsal Angulation	46 (±11)	45 (±14)	0.965
Initial DASH Score	45 (±4.7)	45.1 (±4.8)	0.966
Follow-up DASH Score	17.3 (±5.2)	15.7 (±5.5)	0.341
Clinical Difference	27.7 (±8)	29.4 (±6.9)	0.477

Table 1 Patient Demographics; both groups compared using independent t-test. Categorical values compared using Fisher's exact test. Significance set at $p \leq 0.05$

On presentation, the degree of dorsal apex angle (DAA) and initial QuickDASH® scores did not correlate (Figure1). However, a significant positive correlation between DAA and follow-up QuickDASH® scores was observed with a correlation of 0.847 ($p < 0.001$). Both cohorts achieved CD above 16 (MCID). This may mean that patients' symptoms improve even with a high degree of DAA on radiographs regardless of which treatment option. A significant positive correlation was observed when comparing CD with presenting QuickDASH® scores ($p < 0.001$) and the DAA. This means that in our cohort of patients, significant improvement of symptoms was reported even with high DAA and initial QuickDASH®. This data is summarized in Table 2.

Similar significant correlations between pre- and post-treatment scores of both cohorts with the DAA, initial and follow-up QuickDASH® scores were observed, indicating similar outcomes with regards to treatment modality. Furthermore, no statistical difference was observed in the pre- and post-treatment scores between both cohorts. The

difference between pre- and post-treatment QuickDASH® scores inversely and significantly correlates with the degree of fracture angulation, Pearson -0.643 ($p < 0.001$). This translates to greater improvement of symptoms as perceived by patients with higher DAA. Interestingly, the clinical difference (CD) in scores had a significant positive correlation with QuickDASH® scores on presentation, Pearson 0.696 ($p < 0.001$). This may mean that patients with higher initial disability are more likely to experience a higher degree of improvement. The data are summarised in table 3 and illustrated in figure 1.

Associations Assessed	N	Correlation	Sig.
Degree of Dorsal Apex Angle & Initial QuickDASH® Score	39	-0.051	0.756
Degree of DAA & Follow-up QuickDASH®	39	0.847	<0.001
Degree of DAA & CD	39	-0.643	<0.001
Initial DASH Score & Follow-up QuickDASH® Score	39	-0.089	0.589
Initial QuickDASH® Score & CD	39	0.696	<0.001

Table 2 Comparison of clinical measures following injury. Association between injury presentation characteristics and outcomes were compared using paired t-test. Significance is set at $p \leq 0.05$.

Discussion

This study aims to assess the patient-reported outcome of two common techniques used to treat non-complex 5th metacarpal fractures. Thus, allowing non-specialist treatment and follow-up, quicker return to work and daily activities, as well as improve treatment cost-effectiveness. Currently, non-surgical management is the mainstay. Hence this study is merited, however, there is no consensus between surgeons to which modality of treatment is best used [15, 16].

A Cochrane review looking at the clinical, radiological and functional outcomes comparing different conservative treatments, showed similar outcomes between both regimens [17]. Kanyak et al concluded that there is no statistical difference between the use of the functional metacarpal splint and Ulnar Gutter Cast in terms of final patient's grip strength and the final patient-reported outcomes using the QuickDASH® score. However, they have reported that the patient treated with functional metacarpal splint (FMS) regained grip strength significantly earlier compared to patients treated with UGC (18).

To the best of our knowledge, the evidence in the literature looking at the improvement of function as reported by the UK patient with either the UGC vs the BT or comparing the improvement after the use of both modalities is generally lacking. The improvement of function as measured by the clinical difference (CD) is considered a more objective measure of the efficacy of the treatment rather than an arbitrary QuickDASH® score at

the end of treatment. According to Franchignoni et al, the minimally clinically important difference (MCID) for the QuickDASH® score is more relevant when set at 16. This essentially means that a significant improvement is considered when the change between pre- and post-treatment QuickDASH® scores is equal to or more than 16 [13, 14].

On presentation, the degree of dorsal apex angle (DAA) did not correlate with the initial QuickDASH® score, indicating that the severity of the deformity on radiographs did not necessarily equate to a worse functional outcome. This is consistent with previous evidence that DAA up to 70 degrees may be treated non-surgically successfully with minimal or no functional deficit (19). This was consistent in both groups with no statistical difference between both cohorts.

The significant positive correlation between the QuickDASH® at presentation and the CD indicates that in patients who suffer more initial disability report better improvement over time. This might be due to the fact that patients experiencing less disability are not hindered in their day-to-day activities and hence do not notice the improvement while their counterparts suffering from more disability find that the improvement in hand function produces more tangible enhancement in their daily activities. The data also shows patients with higher DAA experienced less improvement (i.e. their CD were lower) with either modality. To our knowledge, the correlation between the DAA and the CD was not previously explored before by others in the literature. We believe this is an important observation, as this should give the clinician and the patient the reassurance that despite a higher DAA, a significant improvement is expected.

Both, the BT and the UGC groups, have shown a 27.7 and 29.4 CD respectively. Compared to the initially set value 16, this was found to be a significant improvement. This result confirms that both modalities treat 5th Metacarpal neck fractures effectively [17]. However, there was no statistical significance between both treatment regimens contrary to Kaynak et al [18] who reported significant improvement when using a functional metacarpal splint (FMS) compared to a UGC using a QuickDASH® score.

Our results show that patients in both the BT and UGC groups report similar improvement of QuickDASH® scores from the initial presentation and after an average period of follow-up, 10 and 13 months respectively. This result adds to the body of the previous clinical and radiological evidence that strengthens the message that both BT and UGC are equally effective in treating 5th metacarpal neck fractures [20, 21].

Buddy tapping has shown repeatedly in the literature that it is an effective treatment option for non-complicated 5th metacarpal neck fractures. It has the advantage of being cost-effective. Buddy tapping requires less material used, no plaster technician, a non-specialist clinician for application, no follow up appointments, and less time spent off work. This is a potentially significant cost saving to an already stretched health care system.

			Degree of Dorsal Apex Angulation	Initial QuickDASH® Score	Follow-up QuickDASH® Score
Clinical Difference (CD)	BT	Pearson	-.745**	.779**	-.822**
		Correlation			
		Sig. (2-tailed)	<0.001	<0.001	<0.001
	UGC	Pearson	-.580**	.610**	-.727**
		Correlation			
		Sig. (2-tailed)	0.009	0.006	<0.001
Total	Pearson	-.643**	.696**	-.777**	
	Correlation				
	Sig. (2-tailed)	<0.001	<0.001	<0.001	

Table 3 Correlation of Clinical Difference with the Degree of DAA, Initial QuickDASH® and Follow-up QuickDASH® compared between both groups; BT and UGC.

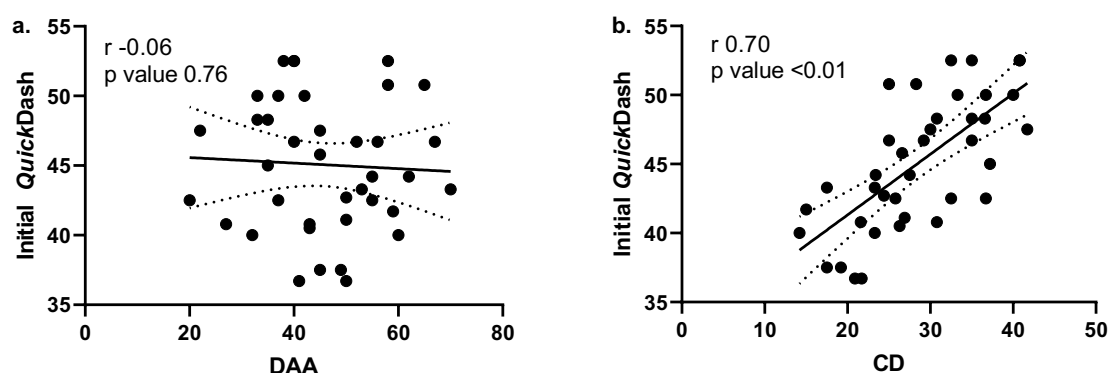


Figure 1. Correlation graphs of clinical measures post-injury. a. Scatter plot showing no direct correlation between initial QuickDASH® score and DAA; b. Scatter plot showing a positive correlation between initial QuickDASH® and CD. Variable correlations assessed using Pearson's r (two-tailed) test. Significance is set at $p \leq 0.05$.

Limitations

Limitations of our study include: 1- relatively small sample size with no power calculation, 2- a variable length of follow up, 3- retrospective, 4- and finally, our study is based on a single unit with no patient randomisation, whereas a multi-center randomised study will provide a wider range of cases and help dilute minor problems inherent with any one treatment centre and reduce selection bias. However, the novel application of patient-reported outcomes pre and post-treatments and the findings may be considered the strength of this analysis. Large, multi-center randomised clinical trials are recommended to validate the observations in this study.

We acknowledge the limitations and we recommend further investigation on a larger scale. In the meanwhile, we also recommend the use of buddy tape and early active motion as the primary choice of treatment of uncomplicated fractures of the neck of the 5th metacarpal and reserve ulnar gutter casts for selected cases.

Conclusion

Patient-reported outcomes confirm that buddy taping and early active motion is as effective as Ulnar Gutter Casting in the management of uncomplicated 5th metacarpal neck

fractures as per patient-reported outcomes. The advantages include less time consumption and fewer follow-up appointments, potentially saving the health care system valuable resources. Larger studies are recommended to validate the observations made.

Level of evidence Level III evidence

Funding The authors declare that they received no funding for this work, nor they have any conflicting financial interest.

Conflict of interests The authors declare no conflict of interest

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