

## **Efficacy of Immobilization Strategies for Boxer's Fracture: A Systematic Review**

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**Abstract:** This systematic review aims to provide an overview of immobilization strategies for boxer's fracture. A boxer's fracture results from a high impact force when in a closed fist position. This systematic review will identify, evaluate, and synthesize the information provided by the selected five articles to determine the efficacy of buddy taping, ulnar gutter casting, and functional metacarpal splints for treating boxer's fracture.

**Importance:** Several immobilization techniques are used for individuals with a fifth metacarpal fracture, also known as a boxer's fracture. All techniques are beneficial for clients in improving functional mobility. However, there is not a lot of research that can identify which immobilization strategy is more efficient in increasing functional mobility.

**Objective:** To identify, evaluate, and synthesize the current literature concerning boxer's fracture to determine the efficacy of immobilization strategies.

**Data Sources:** A literature search occurred between May 6, 2024, and May 12, 2024. Follow up searches were conducted on May 20, 2024. Databases included Google Scholar, EBSCO, and Cochrane using Hawai'i Pacific University's online library databases. Search terms included boxer's fracture, fifth metacarpal fracture, buddy taping, as well as combinations of these terms.

**Study Selection and Data Collection:** This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Published studies on boxer's fracture were included in the systematic review. Data from presentations, non-peer reviewed literature, and dissertations were excluded.

**Findings:** Five studies were included in the systematic review, including three Level I, one Level II, and one Level III according to the American Occupational Therapy Association's Levels of Evidence. The outcomes of these studies indicate that buddy taping is an effective immobilization strategy.

**Conclusion and Relevance:** Buddy taping is effective and improves functional mobility for individuals with boxer's fracture.

**What This Systematic Review Adds:** There are limited high quality studies that evaluate boxer's fracture. This systematic review provides a starting point for evaluating the efficacy of interventions for boxer's fracture in OT practice. More research is needed to assess if there is one

immobilization strategy that is more effective in improving functional mobility of the fifth metacarpal.

**Key words:** Buddy Taping, Boxer's Fracture, Functional Outcomes, Immobilization, Fifth Metacarpal Fractures, QuickDASH, DASH, Casting, Splinting.

## **Introduction**

Boxer's fracture occurs when there is a break in the neck of the fifth metacarpal. These are common injuries that often result from direct impact or accidental falls. These fractures predominantly occur in the male population. The incident rate of a fifth metacarpal fracture is higher among younger adults because they usually participate in more high-risk physical activities. Due to the prevalence of this injury, this systematic review explored effective immobilization methods that promote functional outcomes.

Proactive management of a boxer's fracture is vital to prevent long term complications such as decreased grip strength, reduced range of motion and chronic pain. Administered immobilization interventions included ulnar gutter casting (UGC) and functional metacarpal splints (FMS). In contrast, these interventions require considerable resources, follow up visits, and can cause joint restriction. Buddy taping is a simpler and more cost-effective immobilization intervention making it more advantageous than casting. This systematic review aimed to evaluate the effectiveness of buddy taping and other immobilization techniques using the QuickDASH scoring assessment. The evidence shows that buddy taping has similar clinical results compared to UGC and FMS and offers benefits such as quicker return to work, less restriction to the metacarpophalangeal joints, and lower cost.

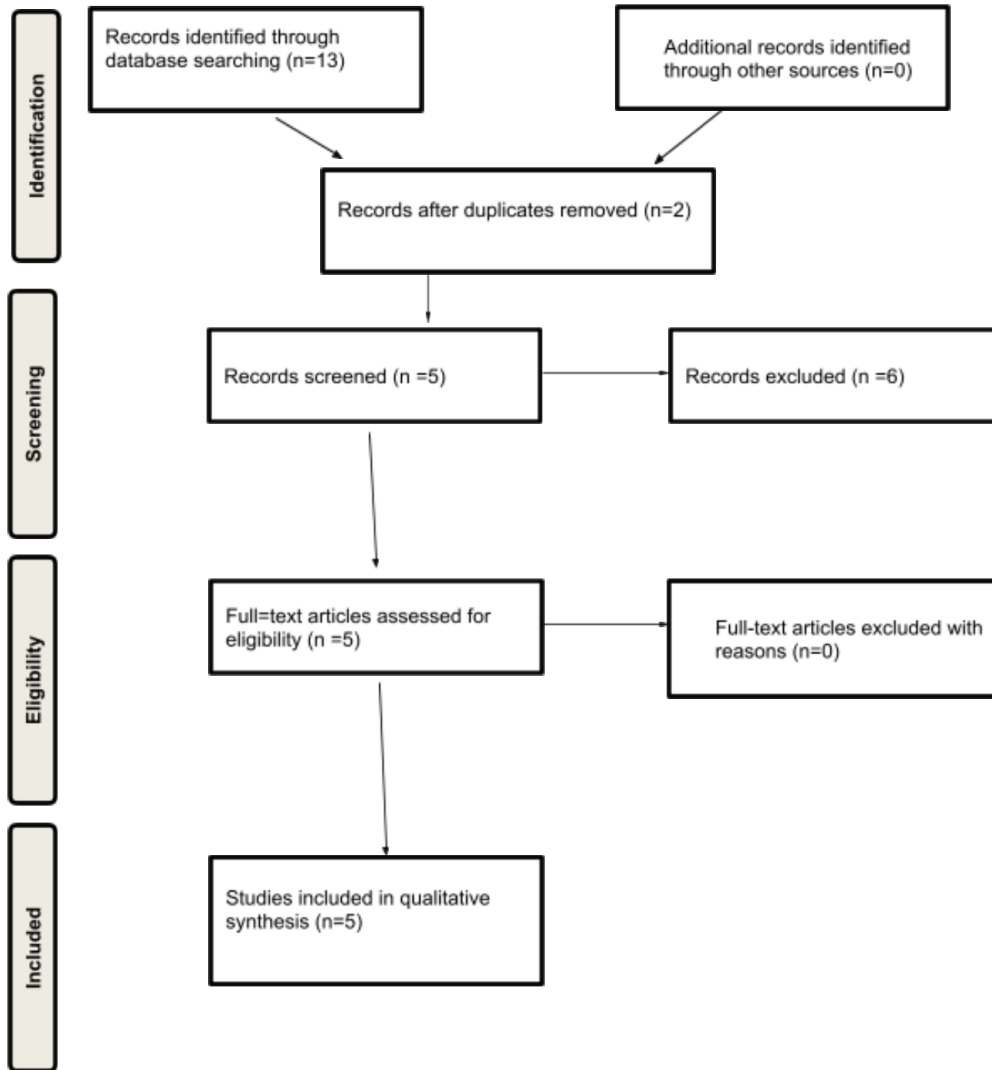
## **Method**

The systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and incorporated recommended processes for conducting a systematic review.

A broad search of the literature occurred between May 6, 2024, and May 12, 2024. An additional search was conducted May 20, 2024, to ensure all relevant research was included. The inclusion criteria for studies in this systematic review were as follows: peer-reviewed, published in English, and dated between 2014-2024. Exclusion criteria, in addition to those studies that did not meet the inclusion criteria, included articles that were systematic reviews, scoping reviews, dissertations, and presentations. A search for relevant literature was completed using electronic databases: Google Scholar, EBSCO, and Cochrane through Hawai'i Pacific University's online library database. Search terms included boxer's fracture, fifth metacarpal fracture, buddy taping, as well as combinations of these terms. Appendix A provides an extensive list of all search terms used for this systematic review. The initial search included 13 articles related to the research topic (Figure 1). Five independent reviewers completed the screening and selection of the studies, assessed their quality, and extracted the data.

**Figure 1**

***PRSIMA Flow Diagram***



## **Results**

Five studies met the inclusion criteria. The articles were assessed according to their risk of bias, level of evidence, and quality. This systematic review included five studies that contained relevant information regarding boxer's fracture. The information from these articles was divided into two themes: interventions and functional outcomes. An evidence table is provided in Appendix B. The Cochrane risk-of-bias guidelines were used to assess each article and are provided in Appendix C.

## Functional Outcomes

Two of the five studies on the topic discussed the efficacy of buddy taping and splints. One of these studies was Level I, and the other was a Level III study (see Appendix B). All studies provided evidence that immobilization strategies for boxer's fracture are effective and potentially beneficial.

Fifth metacarpal fractures are a result of accidental falls or direct impact and occur mostly in males. When evaluating the angulation of the fracture, 30 degrees leads to impaired grip strength and range of motion. However, case reports and randomized controlled trials have proven that with early closed reduction and immobilization, patients with angulations up to 70° can be treated with acceptable functional outcomes (Avinca & Tas, 2024). In the study by Avinca and Tas (2024), the subjects included 52 children under the age of 18 who were treated at the emergency clinic. Every 1, 3, and 6 months the participants and their parents would fill out the QuickDASH survey to assess their functional outcomes. A t-test was used to evaluate all QuickDASH scores. At six months Quick-DASH scores revealed that 82.69% of patients (n=43) had completely regained normal function, and 17.31% of patients (n=9) had an incomplete recovery (Avinca & Tas, 2024). The results suggest that immobilization of fifth metacarpal fractures in children promotes proper healing with increased functional outcomes.

Khashaba et al. (2020) conducted a retrospective analysis comparing buddy taping and ulnar gutter casting for treatment of fifth metacarpal neck fractures in 48 patients using QuickDASH scores. The study found no statistical difference in patient initial and follow-up QuickDASH scores. Both interventions showed similar clinical results in improvement. However, buddy taping stood out as a potentially preferable intervention due to its cost effectiveness, less time off work, reduced cost and materials, and fewer follow up appointments needed. In both treatment groups, the cause of the injury was due to a punch. Both intervention groups received a clinical difference above 16 which may mean that patients' symptoms improved even with high Dorsal Apex Angle (DAA). DAA is the way that intrinsic and extrinsic muscles are pulled during the event of injury causing a tilt. All patients in the study had less than 3mm shortening and a DAA equal or less than 70 degrees measured on radiographs on the true lateral view. A significant positive correlation was found between the DAA and QuickDash scores. This could possibly hint that patients with a higher disability are more likely to experience a higher degree of improvement (Khashaba et al., 2020). Both groups showed an average of 28 in clinical difference compared to the initial rating of 16. This result confirms that both interventions are effective in treating fifth metacarpal fractures. This is contrary to Kaynak et al. (2019) where results from QuickDASH scores favored a functional metacarpal splint compared to ulnar gutter casting.

## **Interventions**

Three of the five studies discussed the efficacy of buddy taping and splinting. Two of these studies were Level I studies, and one article was a Level II study (see Appendix B). All studies provided evidence that buddy taping and splinting is effective and potentially beneficial.

Kaynak et al. (2019) compared functional metacarpal splints (FMS) and ulnar gutter casting (UGC) for treating fifth metacarpal neck fractures. The study involved 40 patients, 22 were treated with FMS, and 18 with UGC. Follow-up visits were conducted during week one, month one, month two, and month six post-surgery. Significant improvement was achieved in both groups, but the average angulation was lower in the group treated with FMS. Patients treated with FMS showed faster and improved results during the second- and sixth-month follow-up on QuickDASH scores and grip strength, in comparison to the UGC group that showed significantly lower results during the second follow up period. However, both interventions showed similar results during the six month follow up. In stable fifth metacarpal fractures, FMS is suitable to prevent reduction, restriction of joints and functional movement and provides faster improvement in clinical scores and earlier gain of normal grip strength in comparison to UGC.

Golby et al. (2020) compared two interventions, buddy taping and ulnar gutter plaster cast, using the DASH assessment. In addition to the DASH, study outcomes included patients' pain level and satisfaction. One benefit to this study was the researchers included the patients' pain level and patients' satisfaction. The results of the study were five patients (8.1%) from the buddy taping group and seven patients (11%) from the plaster immobilization group improved clinically. Functional disability scores at 12 weeks were minimal for groups (Golby et al, 2020).

When comparing buddy taping to immobilization via casting for fifth MCP neck fractures, it was found that buddy taping had better short-term outcomes if the fracture was not too angulated (Martínez-Catalán et al., 2020). Use of buddy taping had good results in patients returning to work 28 days faster than cast immobilization (Martínez-Catalán et al., 2020). Additionally, patients in the buddy taping group had improved ROM, grip strength, and a lower DASH score ( $19.7 \pm 19.7$ ) when compared to cast immobilization ( $44.6 \pm 15.0$ ), which indicates a lower level of disability. Clinical outcomes were better with ROM and DASH scores for the buddy taping group with a mean difference of 6.3 (Martínez-Catalán et al., 2020). The cast immobilization group had a higher complication rate.

## **Discussion**

The results of this systematic review suggest that buddy taping is effective to improve functional outcomes for individuals with boxer's fracture. There has been some success in functional outcomes with the use of buddy taping in comparison to casting. Buddy taping, casting, and splinting are all common immobilization strategies used for individuals with the

fifth metacarpal fracture. Buddy taping is a preferred method due to it being less-costly, less time required away from work, fewer resources required, and minimal follow-up appointments needed when compared to ulnar gutter casting (Khashaba et al. 2020). In another study, buddy taping resulted in participants returning to work 28 days sooner than the participants who had casting for their boxer's fracture (Martínez-Catalán et al., 2020). It can be inferred that buddy taping is the least intrusive immobilization strategy for those with a boxer's fracture.

There appears to be a difference in functional outcomes between the different immobilization strategies. Participants who were in the plaster group for immobilization scored higher in the QuickDASH compared to the buddy taping group, indicating a greater level of disability (Golby et al, 2020). One study found that the intervention of buddy taping had improved range of motion, lower DASH scores, and an increase in grip strength (Martínez-Catalán et al., 2020). When comparing results of buddy taping to casting, overall buddy taping had better results with a mean difference of 6.3 in DASH scores (Martínez-Catalán et al., 2020).

This systematic review included one study with participants who required surgery for their fifth metacarpal fracture. Post-surgery, participants were put into ulnar gutter casts or functional metacarpal splints (Khashaba et al., 2020). Both immobilization strategies showed similar results. However, no other studies in the systematic review included participants who needed surgery for their boxer's fracture.

This systematic review suggested that buddy taping leads to increased functional outcomes when compared to other immobilization strategies. Some studies demonstrated that other immobilization techniques can also improve functional mobility, but these options are more costly, include more follow-up appointments, and can limit functional mobility during the intervention. The QuickDASH and DASH assessments were the primary outcome measures in the studies.

### **Strengths and Limitations**

The limitations of the systematic review include: the short duration to complete the review (i.e., 6 weeks), a limited number of studies included in the review, and limitations and risk-of-bias within the studies (e.g., participants who were lost during the follow up period; evaluation of the fracture angulation was not performed).

The strengths of the systematic review included database resources to complete a thorough search of the literature, use of the PRISMA guidelines for conducting a systematic review, and multiple reviewers participating in the process.

## **Implications for Occupational Therapy Practice**

Evidence suggests that buddy taping and splint casting enhanced patients' overall quality of life. Some studies used occupational therapy assessments to measure the impact of interventions on functional outcomes.

- Buddy taping has the potential to improve functional outcomes.
- The systematic review revealed that the QuickDASH outcome measure is a commonly used assessment tool.
- Occupational therapy practitioners should evaluate clients' pain levels and overall satisfaction.
- It is important to monitor patients' progress and modify the treatment plan as needed based on functional goals and pain levels.

## **Conclusion**

Studies included within this systematic review provide evidence on the effectiveness of buddy taping. Additional research is necessary to further prove that buddy taping is a more effective immobilization strategy for individuals with boxer's fracture. When looking at immobilization techniques, practitioners should consider which is the least intrusive option that can improve the client's overall function and well-being.



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## **Appendix A**

### *Search Terms*

buddy taping

AND

boxer's fracture or fifth metacarpal fracture or hand fracture

AND

quick dash

## Appendix B

### Evidence Table

Research question: Does buddy taping increase functional mobility of the involved finger for individuals with boxer's fracture?

Author/Year	Level of Evidence Study Design Risk of Bias	Participants Inclusion Criteria Study Setting	Intervention and Control Groups	Outcome Measures	Results
Avinca et al. (2024)	Level I- RCT 2020-2022	children 18 years and younger with fifth metacarpal neck fractures	3 groups 2 interventions: - immobilization, splinting	QuickDASH scoring to evaluate post- treatment follow-up	52 patients were included, The mean age was 14.04. 92% were male and 8% were female; QuickDASH scores were evaluated according to trauma and gender. At 6 months QuickDASH scores showed that 82.69% patients had normalized, 17.31% had incomplete recovery
Golby et al. (2020)	Level I- RCT -03/2016- 12/2017	126- lost 26 - 97 participants were analyzed	2 groups 3 interventions - Buddy taping of the ring and little fingers of the affected hand - Immobilization in an ulnar gutter plaster cast applied in a position of safety	1- Hand function at 12- weeks measure using quickDASH 2- pain scores, patient satisfaction, missed work/sports days/ overall quality of life	-5 patients (8.1%) buddy taping group -7 patients (11%) plaster immobilization group crossed over -Buddy taping 0, -Interquartile range (IQR) 0 to 2.3; -Plaster 0, IQR 0 to 4 for a difference of 0; 95% confidence interval for difference 0 to 0)

Martínez-Catalána et al. (2020)	Level 2, randomized control trial, performance bias risk	<ul style="list-style-type: none"> <li>- Started with 78, ended up with 72 adult male and female patients</li> <li>- Acute MCP fractures, volar angulation &lt; 70 degrees</li> <li>- Patients presenting to the emergency room where recruited for this study</li> </ul>	<ul style="list-style-type: none"> <li>- 2 groups</li> <li>- Buddy taping</li> <li>- Jahss maneuver and immobilization</li> </ul>	<ul style="list-style-type: none"> <li>- DASH score 9 weeks from intervention, 3 weeks from intervention, and 1 year from intervention, time for return to work, final angulation, grip strength, ROM, VAS pain score at 3 and 9 weeks, and complication rate</li> </ul>	<ul style="list-style-type: none"> <li>- 3 week DASH score significantly lower in the buddy taping group, as well as lower VAS score and improved ROM and grip strength when compared to the immobilization group</li> <li>- 9 week statistically significance between group 1 and 2, buddy taping group showed better ROM and less time to return to work</li> <li>- Complication rate was lower in buddy taping group</li> </ul>
Kaynak et al. (2019)	Level 1, randomized control trial split between 2 groups	40 patients were analyzed. Patients were ages 18 and older, the fracture had to be 3 days or less old.	2 Groups 2 interventions - Functional metacarpal splint - Ulnar gutter splint	-Dash score - ROM- grip strength - pain levels	-Twenty-two patients were treated with FMS, and 18 patients were treated with UGS. After reduction, significant correction was achieved in both groups, but the average angulation was lower in the FMS group( $16 \pm 7$ ) compared with the UGS group ( $21 \pm 8$ )( $p = 0.043$ ).

<p>Khashaba et al. (2020)</p>	<p>Level III - retro prospected analysis -pre and post treatment between 2 groups</p>	<p>-Initially 48 patients only 39 returned the follow up questionnaire - study conducted at a hospital - closed fracture of the neck of the 5th metacarpal - less than 3mm shortening - DAA less than or equal to 70 degrees</p>	<p>2 Groups 2 interventions - buddy taping - Ulnar gutter cast</p>	<p>- a clinical difference because of a change in the Dash assessment. A CD greater than or equal to 16 indicates improvement in symptoms</p>	<p>-20 patients in BT group - 19 patients in UGC group - Patient age and gender were similar between 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 Quick dash scores were similar between both cohorts.</p>
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## Appendix C

*Risk-of-Bias Table: Randomized Controlled Trial (RCT) and Non-RCT*

	Selection Bias (Risk of bias arising from randomization process)			Performance Bias (effect of assignment to intervention)		Detection Bias		Attrition Bias	Reporting Bias	Overall risk-of-bias (low, moderate, high)
Citation	Random Sequence Generation	Allocation Concealment (until participants enrolled and assigned)	Baseline difference between intervention groups (suggest problem with randomization?)	Blinding of Participants During the Trial	Blinding of Study Personnel During the Trial	Blinding of Outcome Assessment: Self-reported outcomes	Blinding of Outcome Assessment: Objective Outcomes (assessors aware of intervention received?)	Incomplete Outcome Data (data for all or nearly all participants)	Selective Reporting (results being reported selected on basis of the results?)	
Golby et al, (2020)	+	-	+	-	-	-	-	+	-	Moderate
Martínez-Catalán et al., (2020)	+	-	+	-	-	-	-	+	-	Moderate
Avinca et al. (2024)	+	-	+	-	-	-	-	+	-	Moderate
Khashaba et al. (2020)	+	-	-	-	-	-	-	+	-	High

Kaynak et al. (2020)	+	-	-	-	-	-	-	+	-	<b>High</b>
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