Functional Outcomes of Non-surgical Interventions in Adults with 5th Metacarpal Fractures: A Systematic Review

Authorship: Austin Blankenship, OTS, Chanaiya Richards, OTS, Susanne Wexler, OTS, Colbie York, OTS

Abstract: The fifth metacarpal neck fracture is traditionally treated conservatively without surgery by means of cast immobilization. Other alternative and more functional treatments include buddy taping, thermodynamic splints, and plaster splints. The aim of this systematic review is to compare non-surgical interventions and their subsequent functional outcomes.

Importance: Expanding the knowledge of functional outcomes in non-surgical interventions of uncomplicated fifth metacarpal fractures will assist practitioners when deciding which interventions are best suited for this diagnosis.

Objective: To identify, evaluate, and synthesize the current literature concerning fifth metacarpal fractures to determine the efficacy of non-surgical interventions and functional outcomes.

Data Sources: A literature search occurred between May 9, 2024, and May 17, 2024. Follow up searches were conducted on June 24, 2024. Databases included Google Scholar, EBSCO, EBSCOhost, PubMed using Hawai'i Pacific University's online library databases. Search terms included *occupational therapy*, *healing time*, *adolescents*, *fifth metacarpal fractures*, and *splinting.*

Study Selection and Data Collection: This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Published studies on the efficacy of non-surgical interventions and functional outcomes were included in the

systematic review. Data from presentations, non-peer reviewed literature, and dissertations were excluded.

Findings: Five studies were included; three studies were Level 1A and two were Level 1B according to the American Occupational Therapy Association's Levels of Evidence. The outcomes of these studies indicate buddy taping as a conservative treatment is not inferior to surgery and may be more effective.

Conclusion and Relevance: Non-surgical interventions of uncomplicated fifth metacarpal fractures are effective and improve occupations for adults.

What This Systematic Review Adds: There are limited high quality studies that evaluate non-surgical interventions of fifth metacarpal fractures in adults. This systematic review provides a starting point for evaluating the efficacy of non-surgical interventions of fifth metacarpal fractures in adults in OT practice. More research is needed to enhance the knowledge surrounding interventions and functional outcomes.

Key words: 5th metacarpal fracture, adolescents, boxer's fracture, brace, healing time, immobilization, immobilize, occupational therapy, orthosis, splint, teenagers, young adults

Introduction

Fifth metacarpal neck fractures, also known as boxer's fractures, are one of the most common fractures of the hand and it accounts for 20% of all hand fractures (Van Aaken et al., 2015). These fractures mostly occur in the working age population with more males being affected than females. Injuries such as these can have a profound impact on someone's socioeconomic status due to time lost from work. To improve functional outcomes, these fractures are treated non-surgically through means of orthosis immobilization including buddy taping, dynamic splints, or plaster splints.

When the fifth metacarpal neck becomes injured, the normal palmar angulation of the metacarpal head increases. This angulation causes a shortening of the metacarpal neck, which could result in the loss of normal prominence of the fifth metacarpophalangeal joint. The ideal treatment for fifth metacarpal neck fractures remains controversial, with most of the patients being treated without surgery (Van Aaken et al., 2015). The conservative treatments are more cost-effective and require less time to demonstrate an improvement of functional return.

Method

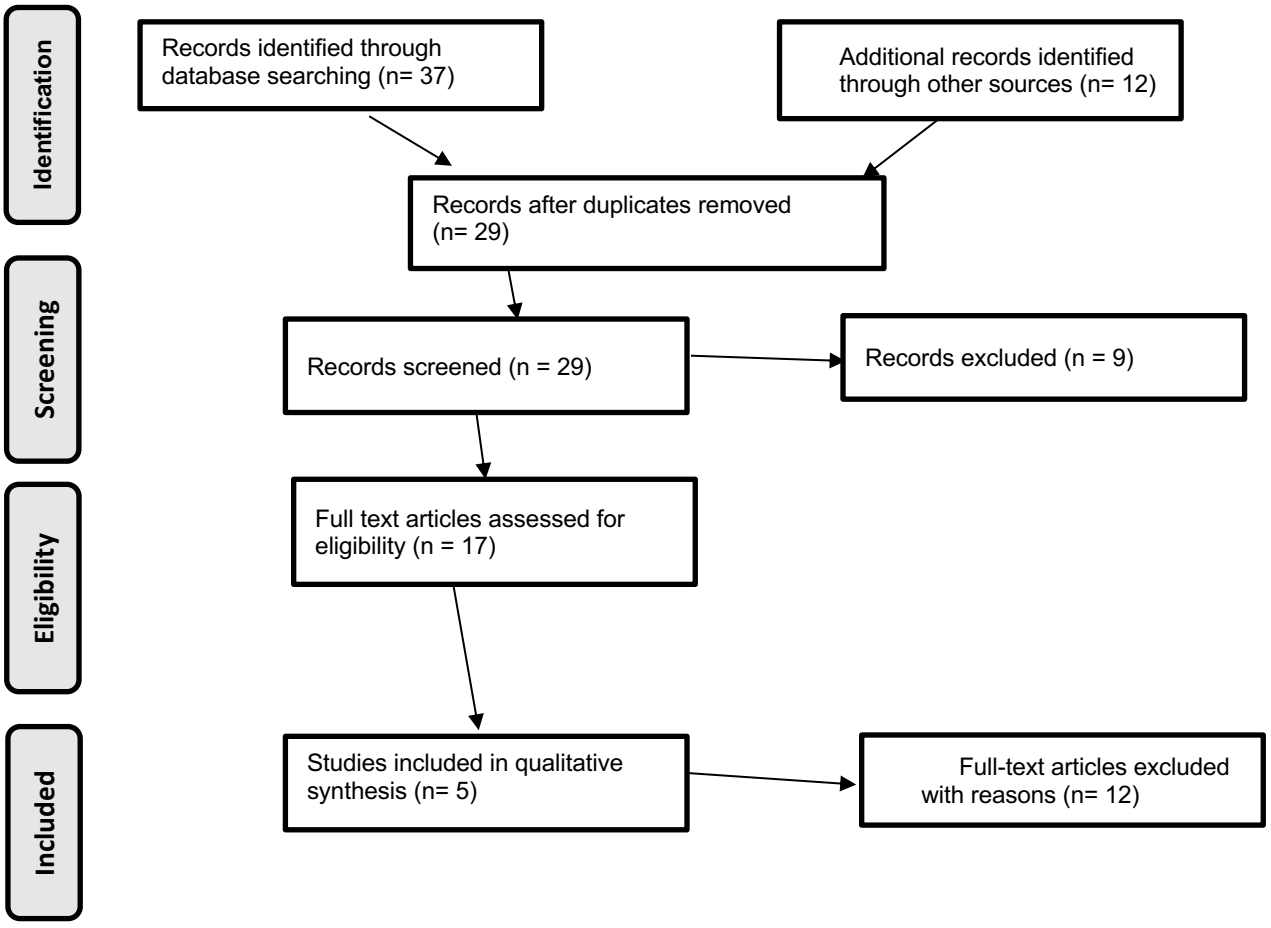
The systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and incorporated recommended processes for conducting a systematic review. The guiding research question for this systematic review was: What non-surgical interventions affect the functional outcomes of fifth metacarpal fractures in adults?

A broad search of the literature occurred between May 9, 2024, and May 17, 2024. An additional search was conducted on May 30, 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 2015-2024. 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, EBSCOhost, and PubMed through Hawai'i Pacific University's online library database. Search terms included *occupational therapy, healing time*, *adolescents*, *fifth metacarpal fractures*, *splinting* 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 37 articles related to the research topic (Figure 1). Four independent reviewers completed the screening and selection of the studies, assessed their quality, and extracted the data.

Figure 1

PRISMA 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 orthotics and outcomes for fifth metacarpal neck fractures (boxer's fractures). The information from these studies was divided into two themes: assessment of functional outcomes and non-surgical interventions. 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.

Assessment of functional outcomes

All five studies included in the systematic review discussed the efficacy of assessing functional outcomes of non-surgical interventions of fifth metacarpal fractures with grip strength (dynamometry), ROM (goniometry) and/or pain (Visual Analog Scale). Three of these studies were Level IA studies and two were Level IB studies (see Appendix B).

Retrouvey et al. (2021) suggest patients treated with elastic bandage and early protected movement experienced an earlier return of normal grip strength than splinting. They divided 37 participants into a splint group (n = 21) and elastic bandages group (n = 16). Grip strength of participants, measured bilaterally, was found at baseline and at each follow-up visit (weeks 4, 8, 12). An average of three trials were taken (17.4 ± 8.6 kg was the average baseline grip strength of the injured hand). This grip strength was 46% of the non-injured hand, and 36% of the average grip strength for Canadian men aged 20 to 39 years (48.5 kg). There was no significant difference in baseline grip strength between the splint group and the elastic bandage group. During week 8, the splint group scored 63% of the Canadian reference value while the elastic bandage group scored 93%.

Yıldırımkaya et al. (2023) divided 103 participants into a short-arm plaster splint (SAPS) group (n = 51) and a dynamic metacarpal stabilization splint (DMSS) group (n = 52). Both groups were assessed at 1-, 2-, and 3-month follow-ups with dynamometry and goniometry. Grip strength of participants in the DMSS group provided better results at each of the follow-ups ($p < 0.001$). Interphalangeal (IP) and metacarpophalangeal (MCP) joints showed improved ROM in the DMSS group at the 1-month visit ($p < 0.001$). Wrist ROM was better in the DMSS group at the 3-month visit ($p < 0.05$). DMSS demonstrated improved early ROM and grip strength compared to SAPS.

Davison et al. (2015) found hand-based thermoplastic splints resulted in improved early ROM and grip strength compared to traditional forearm-based ulnar gutter splints. They divided 40 participants into a hand-based thermoplastic splint group and a forearm-based ulnar gutter splint group. ROM, grip strength and pain were assessed at weeks 3, 6, and 12. At 3 weeks, ROM of the fifth MCP had significantly improved in the thermoplastic splint group with active mean deficits of 5.0 ± 2.6 degrees compared to the ulnar gutter splint group of 27.4 ± 10.3 degrees ($p = 0.048$). Grip strength was measured bilaterally. At 3 weeks ($p < 0.001$) and 6 weeks ($p = 0.047$), the ulnar gutter splint group exhibited decreased grip strength in the injured hand compared to the unaffected hand. Pain remained similar between both groups at all follow-ups.

Martínez-Catalán et al. (2020) suggested reduction and immobilization is not necessary in the treatment of uncomplicated fifth MCP fractures. Also, follow-up beyond week 3 is not necessary when buddy taping fifth MCP fractures. They divided 72 participants into a buddy taping without reduction group (n = 34) and a closed reduction/ulnar cast immobilization group (n = 38). Two follow-ups were performed at weeks 3 and 9 measuring pain, ROM, and grip strength. At week 3, group pain was significantly lower (1.5 ± 1.2 vs 3.2 ± 1.7) and flexion,

extension and abduction of fifth MCP joint had significant improvement for the buddy taping group compared to the closed reduction/immobilization group. Buddy taping is evidenced to be the preferred treatment when compared to closed reduction/ulnar cast immobilization for uncomplicated fifth MCP fractures.

Similarly, Van Aaken et al. (2015) divided 64 participants into a soft wrap and buddy taping group (n = 33) and a closed reduction/cast immobilization group (n = 27). Participants were assessed at baseline and 4-month follow-up. At the 4-month follow-up, there were no statistical differences in pain ($p = 0.289$) or fifth MCP ROM ($p = 0.586$) between the two groups. The results indicate that soft wrapping and buddy taping is not inferior to closed reduction/cast immobilization and that early mobilization is recommended in the treatment of fifth MCP fractures.

Limitations of the studies on assessing functional outcomes of non-surgical interventions of fifth metacarpal fractures with grip strength (dynamometry), ROM (goniometry) and/or pain (Visual Analog Scale) included short duration of splinting following emergency department visit and low target recruitment numbers (Retrouvey et al., 2021). Davison et al. (2015) described different healthcare professionals manufacturing splints. Martínez-Catalán et al. (2020) reported different surgeons reducing fractures among participants. Pain may cease as a measurable outcome as follow-up may have been needed past the four-month mark (Van Aaken et al., 2015). Two out of five studies noted self-reporting of splint adherence (Davison et al., 2015; Retrouvey et al., 2021). Additionally, three out of five studies experienced participants lost to follow-up (Davison et al., 2015; Van Aaken et al., 2015; Yıldırımkaya et al., 2023).

Non-surgical interventions

The effectiveness of buddy taping was discussed in two of the five studies. The effectiveness of elastic bandages was discussed in one study. Traditional plaster splints were discussed in one study. Dynamic stabilization splints were discussed in one study. Forearm ulnar gutter splints were considered effective in one study. The effectiveness of hand thermoplastic splints was discussed in one study. One out of five studies discussed the efficacy of closed reduction/casting compared to buddy taping. Three studies were Level 1A and two were Level 1B. As a result of all the studies, it could be concluded that nonsurgical interventions are both effective and potentially beneficial.

Davison et al. (2016) compared forearm-based ulnar gutter to hand-based thermoplastic splints. Forty patients ages 16 and younger with fifth metacarpal neck fractures were placed into two groups. One group was treated with hand-based thermoplastic splints and one group was treated with forearm-based ulnar gutter splints. The patients treated with the hand-based thermoplastic splints had no complications, and the splints were more effective when compared with the conventional ulnar gutter splints. The study found that hand-based thermoplastic splints are a more effective treatment than forearm-based ulnar gutter splints.

Martínez-Catalán et al. (2020) evaluated 72 patients with fifth metacarpal neck fractures and compared buddy taping to reduction and cast immobilization. Patients had more complications in the cast immobilization group. Time off from work was 28 days shorter with buddy taping compared with cast treatment. The study showed no benefit to reduction and orthosis immobilization of fifth metacarpal neck fractures with an initial angulation less than 70°. The use of buddy taping and early mobilization yielded good clinical results, as well as

significant improvement in time lost from work. There was significant improvement in early stages of treatment with buddy taping.

Similarly, Retrouvey et al. (2021) evaluated 37 participants from five different Canadian centers and compared elastic bandage with early protected movement to immobilization with splinting. The elastic bandage group was treated with a 2" elastic bandage for the palm and wrist worn for 4 weeks without a splint (n=16). The splint group was fitted with a custom plaster/fiberglass splint. A traditional plaster splint or Dynacast Prelude fiberglass splint was applied and secured using a 2" elastic bandage (n=21). Patients treated with immobilization and splinting didn't yield as positive results as the patients that were treated with early protected movement. Participants in the elastic bandage with early protected movement group had better grip strength than participants in the immobilization with splinting group.

A study by Van Aaken et al. (2015) included 64 participants with an average age of 29 years. All participants were skeletally mature with an acute (<7 days) isolated fracture of the fifth MC neck. The use of soft wrap and buddy taping for treatment of boxer's fracture with palmar angulation B70 and no rotational deformity was the preferred method of treatment in this study. Immediate mobilization was the favored treatment over plaster immobilization for the fractures. The fracture angle progression after reduction was unchanged between the two groups.

Yıldırımkaya et al. (2023) examined 119 patients, however, only 103 completed follow-up exams. Fifty-one patients were treated with short-arm splints, and 52 patients were treated with dynamic stabilization splints. The dynamic stabilization splint was found to produce an earlier return to everyday activities. Overall, a dynamic stabilization splint of a boxer's fracture is more effective than a short arm plaster splint.

The studies reviewed had several limitations. The most common limitation was participants lost to follow-up (Davison et al., 2015; Van Aaken et al., 2015; Yıldırımkaya et al., 2023. Other limitations included self-report of splint adherence (Retrouvey et al., 2021; Davison et al., 2015); lack of blinding of surgeons and therapists (Retrouvey et al., 2021); different healthcare professional manufacturing splints (Davison et al., 2015); and different surgeons reducing fractures (Martínez-Catalán et al., 2020). Retrouvey et al. (2021) described low target recruitment numbers and a brief duration of splinting following the emergency department visit.

Discussion

The results of this systematic review indicate that the assessments, used in tandem, are effective at predicting and assessing functional outcomes of fifth metacarpal fractures. All studies provided evidence through outcome measures that can be compared to determine the most efficacious interventions available. In most uncomplicated cases, surgery can be avoided and conservative treatment options like splinting and taping proved more effective to improve functional outcomes. Key assessments included grip strength (dynamometry), range of motion (goniometry), and pain (Visual Analog Scale) (Davison et al., 2015; Martínez-Catalán et al., 2020; Van Aaken et al., 2015; Yıldırımkaya et al., 2023). Grip strength, interphalangeal joint (IP) and metacarpophalangeal (MCP) join measurement, and wrist range of motion (ROM) were seen as the best outcome measures to demonstrate improved return of function associated with the selected interventions.

Clinicians and clients can work together to choose an appropriate intervention. Finding the appropriate intervention will depend on the client's age, mobility, regular occupations, prior level of function and other client factors. Conservative approaches should be considered a first-line treatment for uncomplicated fractures. Splinting was the most popular choice among

interventions. Many splints were evaluated including traditional plaster splint, dynamic stabilization splint, forearm-based ulnar gutter splint and hand-based thermoplastic splint. Overall, each splint provided manageable stabilization during the treatment (Davison et al., 2015; Retrouvey et al., 2021; Yıldırımkaya et al., 2023). Casting and taping provided easy intervention treatments for the client (Martínez-Catalán et al., 2020; Van Aaken et al., 2015). Thus, nonsurgical management of boxer's fractures generally results in more favorable outcomes related to pain, grip strength and ROM.

Strengths and Limitations

The strengths of this systematic review include the intense search of each database, multiple reviewers reviewing qualified articles published in the last ten years, and the use of the PRISMA guidelines for systematic reviews. The studies included in the review met each criterion for the research.

A limitation of the systematic review included the limited research on boxer's fracture. Five studies were included in the systematic review. There is a possibility that related studies were not identified and included in the review.

Implications for Occupational Therapy Practice

The results of this systematic review have the following implications for occupational therapy practice:

- Each intervention has the potential to be beneficial depending upon the fracture complexity and surrounding tissue damage.
- Occupational therapists can monitor pain and swelling in the injury to promote a functional healing process.

- The emerging evidence that different interventions provide different healing outcomes is beneficial for occupational therapists. Occupational therapists can use the best intervention that suits a client's individual needs (Martínez-Catalán et al., 2020).
- Although every fifth metacarpal fracture does not need an orthosis to promote healing, occupational therapists are able to evaluate the impact on an individual's daily activities.
- Occupational therapy collaborates with the client to stabilize and strengthen the fracture through therapeutic interventions. The interventions and assessments effectively measure the client's healing process.
- Creating functional outcomes for conservative treatment of fifth metacarpal fractures will create earlier mobilization with improved performance.

Implications for Occupational Therapy Education

The results of this study have the following implications for occupational therapy education:

- Occupational therapists can educate healthcare providers on the assessments and interventions used to treat individuals with fifth metacarpal fractures.
- Through this evidence, occupational therapists can educate students on the most beneficial treatment designed for clients. Once a treatment is decided on, they can create exercise or stretching routines to gradually strengthen and improve ROM in the fracture. Collaboration of healthcare workers ensures quality care for each client.

Implications for Occupational Therapy Research

The results of this study have the following implications for occupational therapy research:

- Occupational therapists could strive to be informed on the most recent research regarding their practice. Although there is extensive research on boxer's fracture surgical

techniques, there is little evidence on the functional outcomes. There is a need for more research on functional outcomes of boxer's fracture in the scope of occupational therapy practice.

- Grip strength and ROM were identified as the assessments providing the most valuable data concerning functional outcomes (Davison et al., 2015; Martínez-Catalán et al., 2020; Retrouvey et al., 2021; Van Aaken et al., 2015; Yıldırımkaya et al., 2023). Opportunities for research relating to functional outcome measures could add to the body of knowledge surrounding fifth metacarpal fractures.

Conclusion

Studies included within this systematic review provided evidence on the effectiveness of non-surgical interventions on functional outcomes in adults with fifth metacarpal fractures. Additional research is necessary to determine the most appropriate interventions involving more complicated fifth metacarpal fractures. More research related to client pain can be achieved and utilized as a valuable outcome measure.

References

Davison, P. G., Boudreau, N., Burrows, R., Wilson, K.L., & Bezuhly, M. (2016). Forearm-based ulnar gutter versus hand-based thermoplastic splint for pediatric metacarpal neck fractures. *Plastic and Reconstructive Surgery*, *137*(3), 908–916. https://doi.org/10.1097/01.prs.0000479974.45051.78

Martínez-Catalán, N., Pajares, S., Llanos, L., Mahillo, I., & Calvo, E. (2020). A prospective randomized trial comparing the functional results of buddy taping versus closed reduction and cast immobilization in patients with fifth metacarpal neck fractures. *Journal of Hand Surgery*, *45*(12), 1134–1140. https://doi.org/10.1016/j.jhsa.2020.05.013

Retrouvey, H., Jakubowski, J., Al-Taha, M., Steve, A., Augustine, H., Stein, M. J., Al-Halabi, B., Efanov, J. I., Morzycki, A., Tang, D., LeBlanc, M., & Binhammer, P. (2021d). Prospective multicenter randomized controlled trial comparing early protected movement and splinting for fifth metacarpal neck fracture. *Plastic Surgery*, *30*(1), 6–15. https://doi.org/10.1177/22925503211011952

Van Aaken, J., Fusetti, C., Luchina, S., Brunetti, S., Beaulieu, J.Y., Gayet-Ageron, A., Hanna, K., Shin, A.Y., & Hofmeister, E. (2015). Fifth metacarpal neck fractures treated with soft wrap/buddy taping compared to reduction and casting: results of a prospective, multicenter, randomized trial. *Archives of Orthopaedic and Trauma Surgery*, *136*(1), 135–142. https://doi.org/10.1007/s00402-015-2361-0

Yıldırımkaya, B., Söylemez, M.S., Tasçı, M., Uçar, B.Y., & Akpınar, F. (2023). Comparison of the radiological and functional results of a plaster splint and dynamic stabilization splint for Boxer's fractures: A prospective randomized controlled study. *Journal of Orthopaedic Science*. https://doi.org/10.1016/j.jos.2023.08.004

Appendix A

Search Terms

occupational therapy or occupational therapist or occupational therapists or ot AND healing time AND splint or orthosis or orthotic or orthotic type or brace or bracing or splinting or immobilize or immobilization AND boxer fracture or boxers fracture or boxer's fracture or fifth metacarpal fracture AND adolescents or young adults or teenagers

Appendix B

Evidence Table: Functional Outcomes of Non-surgical Interventions in Adults with 5th Metacarpal Fractures

Levels of Evidence					
Author/Year	Level of Evidence Study Design Risk of Bias	Participants Inclusion Criteria Study Setting	Intervention and Control Groups	Outcome Measures	Results
Davison et al. (2015) [doi:10.1097/01.prs.0000479974.45051.78]	Level of Evidence: 1B Study Design: blinded, 1:1 allocation, two-arm parallel group, superiority design, RCT Risk of Bias: Low	Participants: n = 40 Inclusion Criteria: aged 16 years or younger presented within 1 week of injury with isolated fifth metacarpal neck fractures Study Setting: pediatric tertiary hospital	Intervention: Patients were immobilized for 3 weeks in a conventional forearm-based ulnar gutter or hand-based thermoplastic splint	Outcome Measure: Primary Outcome: Range of Motion (goniometer) Secondary Outcomes: Fracture Union, grip strength (dynamometer), treatment adherence, pain (numeric pain scale diary entries), Patient-reported functional outcomes (Adolescent Pediatric Outcomes Data Collection	Results: A functional hand-based thermoplastic splint resulted in improved early range of motion and grip strength compared with a conventional forearm-based plaster ulnar gutter splint
Martínez-Catalán et al. (2020)	Level of Evidence: 1A	72 patients completed the study 34 in group 1 (buddy taping), 38	Intervention and Control Groups: Group 1 was treated with buddy taping	Outcome measure: Primary outcome: DASH score	Results: At 3 weeks group 1 had a lower VOS and DASH score

[doi:10.1016/j.jhsa.2020.05.013]	Study Design: Randomized clinical trial Risk of bias: Low	in group 2 (closed reduction and cast immobilization).	of the fourth and fifth metacarpals for three weeks. Group 2 had closed reduction of the fracture and cast immobilization.	Secondary outcome: angulation of fracture, grip strength, ROM and VAS	than group 2. ROM was better in group 1. Time off from work was 28 days shorter with buddy taping compared with cast treatment.
Retrouvey et al. (2021) [doi.org/10.1177/22925503211011952]	Level of Evidence: 1B Study Design: A multicenter, prospective parallel group randomized controlled trial; Risk of bias: Moderate	Study Participants: 37 participants from 5 Canadian centers Splint group (n=21) or elastic bandage group (n=16) 26 Males (97%), with an average age of 34 +/- 14 years Inclusion criteria: > 18 years old, had a radiographically diagnosed Boxer's fracture, seen by a Plastic Surgeon within 10 days of injury	Intervention and Control Groups: The elastic bandage group was treated with a 2" elastic bandage for the palm and wrist-worn for 4 weeks without a splint (n=16) The splint group was fitted with a custom plaster/fiberglass splint. A traditional plaster splint or Dynacast Prelude fiberglass splint was applied and secured using a 2" elastic bandage (n=21)	Outcome Measures: Comparison of functional and PROs with Boxer's fractures who were treated with splinting vs. elastic bandages Grip strength between the injured and non-injured hand. (bMHQ), grip strength, and Mann-Whitney U nonparametric tests were performed. For the bMHQ, there was no significant difference in the splint or elastic	There were no significant differences in the bMHQ score between the splint or the elastic bandage; There were no differences in baseline grip strength between the splint and elastic bandage groups.

		Intervention Study setting: 5 different Canadian Hospitals		bandage group scores. The results are significant in encouraging providers to manage Boxer's fractures with early protected movement.	
Van Aaken et al. (2015) [doi:10.1007/s00402-015-2361-0]	Level of Evidence: 1B Study Design: Multicenter, prospective, randomized control trial Risk of bias: Moderate	Study Participants: Patients were randomized to the SW or the RC group using a cross-off list. 68 participants, SW group (n=37) RC group (n=27) Participants that dropped out (n=4) Resulted in 64 participants 65 Men with a mean age of 29 Inclusion Criteria: Skeletally mature patients with an acute (<7 days)	Interventions: (SW) group (n=37): This treatment consisted of no reduction with early mobilization. A circular self-adherent wrap (CobanTM, 3M, Saint Paul, Minnesota, USA) was applied covering the 2nd through 5th metacarpals. (RC) group (n=27): This treatment consisted of reduction of the	Outcome Measures: The primary outcome was based on the shortened Disabilities of the Arm, Shoulder and Hand (quickDASH) questionnaire, pain was assessed using the VAS, satisfaction of esthetics, ROM of the 5th MCP joint, and power grip.	Results: There were no statistical differences regarding pain, satisfaction with the esthetic appearance, the ROM of the 5th MCP joint or power grip. The fracture angle progression after reduction was unchanged between the two groups.

		isolated fracture of the 5th MC neck who were willing to participate in the study Study Setting: Conducted in four different hospitals in Switzerland and the United States	fracture and an MCP-extension cast to maintain reduction. A 3-point molded cast was applied to the 5th MC neck fracture. This cast extended to the proximal interphalangeal (PIP) joint and immobilized the MCP joint in extension.		
Yıldırımkaya et al. (2023) [doi:10.1016/j.jos.2023.08.004]	Level of Evidence: 1B Study Design: Randomized clinical trial Risk of bias: moderate	119 patients (103 completed follow-up exams) 51 patients treated with short-arm splints 52 patients will be treated with dynamic stabilization splints	Compared the differences between short arm splints and dynamic stabilization splints. Patients were examined every ten and twenty days and every 1,2 and 3 months after treatment. The examinations were focused on range of motion and alignment of the fracture.	Grip strength range of motion self care and daily activities improvements were the intended outcomes. Grip strength was measured with a dynamometer.	Overall, a dynamic stabilization splint of Boxer's fracture is more effective than a short arm plaster splint.
Note. [Define any acronyms used]Brief Michigan Hand Questionnaire (bMHQ), patient-reported outcomes (PROs), Shortened Disabilities of the Arm, Shoulder and Hand (Quick DASH), Soft Wrap and Buddy Taping (SW), Reduction and Cast (RC), visual analog scale of pain in mm (VAS), range of motion (ROM)					

Appendix C

Risk-of-Bias Table

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	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 the basis of the results?)	
Davison et al. (2015)	+	+	-	+	+	-	+	+	+	Low
Martínez-Catalán et al. (2020)	+	+	-	-	-	-	+	+	+	Moderate
Retrouvey et al. (2021)	+	+	-	-	-	-	+	+	+	Moderate
Van Aaken et al. (2015)	+	+	-	-	-	-	+	+	+	Moderate

Yıldırımkaya et al. (2023)	+	+	-	-	-	-	+	+	+	Moderate

Note. Categories for risk of bias are as follows: Low risk of bias (+), unclear risk of bias (?), high risk of bias (–). Scoring for overall risk of bias assessment is as follows: 0–3 minuses, low risk of bias (L); 4–6 minuses, moderate risk of bias (M); 7–9 minuses, high risk of bias (H).

Citation. Table format adapted from Higgins, J. P. T., Sterne, J. A. C., Savović, J., Page, M. J., Hróbjartsson, A., Boutron, I., . . . Eldridge, S. (2016). A revised tool for assessing risk of bias in randomized trials. Cochrane Database of Systematic Reviews 2016, Issue 10 (Suppl. 1), 29–31. https://doi.org//10.1002/14651858.CD201601