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Original Research Article

Functional Outcomes Following Delayed Hemi-Hamate Arthroplasty for Proximal Interphalangeal Joint Reconstruction

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Abstract: ***Background***: Proximal interphalangeal (PIP) joint fracture-dislocations represent challenging injuries in hand surgery, particularly when presentation is delayed. Hemi-hamate autograft arthroplasty has emerged as an effective biological reconstruction option, though most literature focuses on acute injuries. This report specifically addresses the challenges and outcomes in chronic presentations where delayed treatment is necessitated. ***Case Presentation***: We report the case of a 23-year-old male mechanic who presented with pain and swelling of the right middle finger PIP joint since four months following trauma. Clinical examination revealed swelling, tenderness, and significantly restricted range of motion at the PIP joint with intact neurovascular status. Radiographic evaluation demonstrated a comminuted fracture involving more than 40 percent of the volar articular surface of the middle phalanx base with dorsal subluxation. Computed tomography confirmed the fracture pattern and early degenerative changes. The patient underwent delayed hemi-hamate osteochondral autograft arthroplasty with rigid internal fixation followed by intensive hand therapy. The surgical technique involved harvesting partial distal hamate articular surface and securing it to the reconstructed volar base of the middle phalanx using mini-fragment screws. Postoperatively, the patient followed a structured rehabilitation protocol with early passive mobilization progressing to active motion and strengthening exercises. ***Conclusion***: This case demonstrates that hemi-hamate arthroplasty can achieve satisfactory functional outcomes even when performed four months after injury, though delayed presentation presents additional challenges including joint contracture and soft tissue scarring. The procedure offers a biological reconstruction option that preserves joint motion and provides potential for long-term durability, making it suitable for young, active patients with chronic PIP joint fracture-dislocations.

Keywords: Proximal Interphalangeal Joint; Fracture-Dislocation; Hemi-Hamate Arthroplasty; Osteochondral Autograft; Delayed Reconstruction; Hand Injuries; Finger Injuries; Joint Reconstruction; Hamate Bone; Middle Phalanx.

INTRODUCTION

Proximal interphalangeal (PIP) joint injuries account for nearly 10–15% of hand trauma and are critical due to the joint's role in providing about 85% of total finger flexion.[1,2] Fracture-dislocations involving the articular surface are particularly challenging because of complex biomechanics and poor tolerance for incongruity. Conventional treatments such as extension block pinning, external fixation, volar plate arthroplasty, and silicone arthroplasty have notable limitations, especially in comminuted or unstable injuries.[3–5]

The hemi-hamate autograft technique, described by Hastings and Carroll, reconstructs the volar lip of the middle phalanx using the distal articular surface of the hamate.[9] Owing to its close anatomical match, this method provides a congruent osteochondral surface and has shown good outcomes in acute settings,

including improved range of motion, pain relief, and functional recovery.[7,8,10,11]

Chronic PIP joint injuries (>2–3 months) pose added challenges due to fibrosis, cartilage degeneration, and capsular contracture, and evidence for delayed hemi-hamate arthroplasty remains limited.[7,11,12] This case report describes a patient treated four months post-injury to evaluate functional outcomes following delayed reconstruction. The findings aim to contribute to the sparse literature on chronic PIP joint management and assist in surgical decision-making and patient counseling.

CASE PRESENTATION

A 23-year-old male presented to our outpatient department with complaints of pain, swelling, and restricted movement of the right middle finger for four months. The patient reported a history of trauma sustained during a sports-related fall, resulting in direct axial loading of the finger. He experienced immediate pain, swelling, and inability to flex the finger. Initial treatment at a peripheral healthcare facility consisted of conservative management with buddy taping and oral analgesics. Due to persistent symptoms, progressive deformity, and functional impairment affecting activities of daily living, he sought further evaluation at our tertiary care center.

The patient had no significant past medical history and denied any comorbidities, including diabetes mellitus, hypertension, thyroid disorders, bleeding disorders, or connective tissue diseases. He was employed as an automobile mechanic and expressed concern regarding his inability to return to work, which required fine motor skills, precision grip, and manual dexterity.

Clinical examination revealed fusiform swelling and deformity localized to the proximal interphalangeal (PIP) joint of the right middle finger, measuring approximately 2 cm in maximum diameter. The swelling extended from the distal aspect of the proximal phalanx to the proximal portion of the middle phalanx. The affected finger appeared shortened with lateral deviation compared to adjacent digits. Localized tenderness was present over both the volar and dorsal aspects of the PIP joint, with maximal tenderness at the base of the middle phalanx. The overlying skin was intact with no signs of erythema, warmth, ecchymosis, or infection.

Range-of-motion assessment demonstrated marked restriction of both active and passive movements at the PIP joint. A fixed flexion deformity of 10° was noted, with further active flexion limited to 20°. The patient was unable to make a complete fist, and during attempted grip, the affected finger remained relatively extended at approximately 15° of PIP flexion compared with adjacent digits. Movements at the metacarpophalangeal and distal interphalangeal joints were within normal limits. Grip strength was significantly reduced compared to the contralateral hand. Neurovascular examination was unremarkable. Anteroposterior and lateral radiographs of the right hand demonstrated a comminuted fracture involving the volar lip of the base of the middle phalanx with dorsal subluxation of the middle phalanx relative to the proximal phalanx head. There was loss of articular congruity at the PIP joint, with dorsal widening and volar narrowing of the joint space. The fracture involved more than 40% of the articular surface, indicating an unstable injury pattern. The fracture fragments appeared mildly sclerotic, suggestive of chronicity. No additional fractures were identified, and adjacent MCP and DIP joints were preserved.

Computed tomography confirmed a highly comminuted fracture of the volar base of the middle phalanx involving approximately 45% of the articular surface, with persistent dorsal subluxation and disruption of normal PIP joint congruity. Early degenerative changes and capsular thickening were also noted, consistent with a chronic neglected injury. These findings rendered the injury unsuitable for conservative management or simple reduction techniques.

Based on clinical and radiological findings, the injury was classified as a chronic, unstable PIP joint fracture-dislocation involving more than 40% of the articular surface. Considering the delayed presentation, extensive articular involvement, young age, high functional demands, and the need for joint preservation, hemi-hamate osteochondral autograft arthroplasty was planned. The surgical procedure, postoperative rehabilitation protocol, expected outcomes, and potential complications—including donor site morbidity, graft failure, joint stiffness, and infection—were discussed in detail. Written informed consent was obtained.

SURGICAL PROCEDURE

The patient was taken to the operating room and placed supine on a radiolucent operating table. Regional anesthesia was administered in the form of a supraclavicular brachial plexus block, supplemented with intravenous sedation. The right upper limb was prepared and draped in a standard sterile manner. A pneumatic tourniquet was applied to the proximal arm and inflated to 250 mmHg following limb exsanguination using an Esmarch bandage.

A curvilinear volar “shotgun” approach centered over the proximal interphalangeal (PIP) joint of the right middle finger was utilized, with adequate proximal and distal extension to ensure optimal exposure as described in established AO techniques. The radial and ulnar digital neurovascular bundles were meticulously identified and protected throughout the

procedure. The flexor tendon sheath was opened between the A2 and A4 pulleys, and the flexor digitorum profundus and superficialis tendons were gently retracted using a vessel loop to expose the volar aspect of the PIP joint. Intraoperatively, the volar plate was found to be markedly scarred, contracted, and adherent to the base of the middle phalanx, consistent with a delayed presentation. Careful release of the volar plate from its proximal attachment was performed while preserving its distal insertion to allow joint exposure, mobilization, and later repair. Partial release of the collateral ligaments was carried out as required to achieve adequate visualization of the joint surface.

The fracture site was then identified, revealing comminuted fragments of the volar lip of the base of the middle phalanx with interposed fibrous tissue and early callus formation, consistent with a chronic neglected dorsal fracture-dislocation. Thorough debridement of fibrous tissue, degenerated cartilage, and non-viable bone was performed to create a healthy recipient bed. The residual fracture fragments were deemed unsuitable for stable internal fixation and were excised. A well-defined rectangular osteochondral defect was fashioned at the volar base of the middle phalanx using a rongeur and fine oscillating saw. The defect measured approximately 10 mm in the anteroposterior dimension and involved nearly 45% of the articular surface, fulfilling the accepted indication for hemi-hamate arthroplasty in chronic cases.

Attention was subsequently directed to harvesting the osteochondral autograft from the hamate. A separate longitudinal dorsal incision measuring approximately 3 cm was made over the fourth–fifth carpometacarpal interval along the ulnar aspect of the hand, in accordance with AO recommendations. Blunt dissection was carried down carefully, protecting the dorsal sensory branches and the motor branch of the ulnar nerve. The extensor tendons were retracted to expose the dorsal distal articular surface of the hamate. Based on the measured defect, an appropriately sized osteochondral graft was outlined and harvested using an oscillating saw under copious saline irrigation, ensuring inclusion of intact hyaline cartilage with adequate subchondral bone. The graft was then carefully contoured to reproduce the native concave volar buttress of the middle phalanx base.

The prepared graft was positioned into the recipient defect, and trial reduction of the PIP joint was performed to assess graft fit, restoration of joint congruity, and stability. Once satisfactory alignment was achieved, the joint was reduced and the graft provisionally stabilized. Definitive fixation was accomplished using two 1.5 mm mini-fragment cortical screws inserted in a volar-to-dorsal direction, with careful countersinking to ensure that screw heads were recessed below the cartilage surface and did not violate the reconstructed articular surface. Intraoperative fluoroscopy confirmed accurate graft placement, appropriate screw length, restoration of joint congruity, and correction of dorsal subluxation. The PIP joint was gently taken through a passive range of motion to confirm stability, smooth articulation, and absence of graft impingement or crepitus. The volar plate was subsequently repaired and reattached to the flexor sheath to prevent postoperative hyperextension, and collateral ligament integrity was restored where required. Hemostasis was achieved, and both the recipient and donor sites were thoroughly irrigated. The flexor tendon sheath and skin were closed in layers using absorbable sutures for deep tissues and non-absorbable sutures for the skin. Sterile dressings were applied, and a volar extension-block splint was placed with the PIP joint maintained in approximately 20° of flexion to protect the reconstruction while allowing early tendon gliding, in line with standard postoperative protocols for hemi-hamate arthroplasty.

The total operative time was 135 minutes, and estimated blood loss was minimal (approximately 30 mL). The patient tolerated the procedure well and was transferred to the recovery room in stable condition.

Figure 1: Pre- operative anteroposterior and lateral radiographs

Clinical images:

Figure 2: Preoperative clinical photograph showing fusiform swelling and deformity of the right middle finger PIP joint with visible flexion contracture.

Figure 3: Intraoperative view showing volar approach to the PIP joint with exposure of the fracture site and comminuted fragments.

Figure 4: Surgical dissection revealing the volar lip fracture of the middle phalanx base with fibrous tissue and early callus formation.

Figure 5: Measurement of the harvested osteochondral autograft from the distal hamate using a sterile ruler.

Figure 6: The hemi-hamate autograft showing intact articular cartilage, being measured for appropriate size matching.

Figure7: Intraoperative photograph demonstrating placement of the hamate autograft into the recipient defect at the volar base of the middle phalanx.

Figure 8: Final measurement and assessment of graft positioning before fixation with K-wires.

Figure 9: Donor site at the dorsal wrist showing the hamate harvest site with minimal tissue dissection.

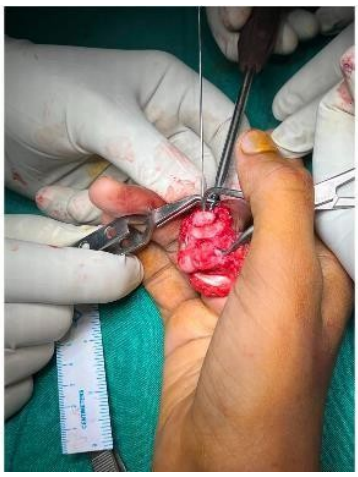

Figure 10: Intraoperative view showing the reconstructed PIP joint with graft in place and preparation for K-wire fixation.

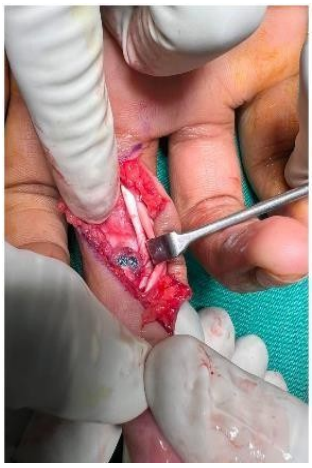

Figure 11: Final intraoperative photograph showing the graft secured with two 1.0 mm K-wires and volar plate repair.

Figure 12: Post-operative fluoroscopic image confirming proper graft alignment and hardware placement.

POSTOPERATIVE COURSE

Neurovascular status of the digits was checked regularly and remained intact throughout. Postoperative radiographs on day 1 confirmed satisfactory graft position and hardware placement.

The volar splint was maintained for 2 weeks to allow initial graft incorporation. Sutures were removed at 2 weeks, and wound healing was satisfactory with no signs of infection.

At 2 weeks postoperatively, the splint was removed, and a structured hand therapy program was initiated under the supervision of a certified hand therapist. The rehabilitation protocol included:

- Weeks 2-4: Passive range of motion exercises with therapist supervision, edema control with compression garments, and scar massage
- Weeks 4-6: Active-assisted range of motion exercises, gentle blocking exercises for isolated PIP joint motion
- Weeks 6-8: Progressive active range of motion exercises, gentle resistance exercises with therapy putty
- Weeks 8-12: Progressive strengthening exercises, functional activities, and gradual return to activities of daily living

The patient was highly compliant with the rehabilitation protocol and attended all therapy sessions regularly.

FOLLOW-UP AND OUTCOMES

At 6 weeks follow-up, radiographs showed signs of graft incorporation with trabecular bridging visible at the graft-host interface. The joint appeared congruent with no signs of subluxation or hardware failure.

At 3 months postoperatively, the patient had achieved significant functional improvement. The donor site at the hamate had healed completely with no residual pain or functional impairment. The patient reported minimal pain at the PIP joint, rated as 1 out of 10 on the visual analog scale during activities of daily living, with occasional mild discomfort during power grip activities.

Range of motion assessment at 3 months revealed:

- **PIP joint active flexion: 65 degrees** (improved from 20 degrees preoperatively)
- **PIP joint passive flexion: 75 degrees** (improved from 35 degrees preoperatively)
- **Extension lag: 10 degrees** (improved from 15 degrees fixed flexion deformity preoperatively)
- **Total active motion arc: 55 degrees** (flexion 65 degrees - extension lag 10 degrees)
- MCP joint: 85 degrees flexion (unchanged from preoperative status)
- DIP joint: 65 degrees flexion (slightly improved from 60 degrees preoperatively)

Grip strength measured by Jamar dynamometer showed improvement to 32 kg compared to 42 kg in the contralateral hand (76% of normal side). The patient was able to perform most activities of daily living including writing, eating, and self-care without difficulty. He had returned to light duty work at his automobile mechanic job, avoiding heavy power grip activities as per rehabilitation protocol.

At 1 Year follow-up, the patient had achieved near-maximal functional recovery. PIP joint flexion had improved to 70 degrees actively and 80 degrees passively, with extension lag reduced to 8 degrees. Grip strength had improved to 36 kg (86% of contralateral side). Radiographs showed complete graft incorporation with maintenance of joint congruity and no evidence of hardware complications, avascular necrosis, or progressive arthritis. The patient had returned to full duty work and reported overall satisfaction with the outcome, rating his satisfaction as 8 out of 10. He was able to perform all occupational tasks including handling small tools and components requiring precision grip.

DISCUSSION

The management of proximal interphalangeal joint fracture-dislocations remains one of the most challenging problems in hand surgery, particularly when presentation is delayed. Our case of a 23-year-old male who underwent hemi-hamate arthroplasty four weeks after injury demonstrates that acceptable functional outcomes can be achieved even with delayed surgical intervention, though the results must be carefully interpreted in the context of existing literature.

The hemi-hamate autograft technique has gained considerable acceptance since its popularization by Hastings and Carroll, with numerous studies reporting favorable outcomes in acute settings.[13] Williams and colleagues reported excellent to good results in 15 of 19 patients treated acutely with hemi-hamate arthroplasty, with mean PIP joint flexion of 73 degrees and extension lag of only 9 degrees at final follow-up.[3] Similarly, Calfee and associates demonstrated that patients treated within three weeks of injury achieved significantly better range of motion compared to those treated later, suggesting that timing plays a crucial role in determining outcomes.[14] In our case, despite the one-month delay, the patient achieved satisfactory reduction of pain and improvement in joint stability, though the final range of motion was somewhat limited compared to acute series, which aligns with the findings reported in delayed reconstruction literature.

The anatomical basis for hemi-hamate arthroplasty lies in the remarkable similarity between the distal articular surface of the hamate and the volar base of the middle phalanx. Capo and colleagues performed detailed morphometric analysis demonstrating that the hamate-capitate articulation closely matches the proximal interphalangeal joint geometry in terms of both radius of curvature and articular surface dimensions.[5] This anatomical congruence allows for restoration of joint biomechanics and provides a vascularized osteochondral graft that can integrate and remodel over time. In our patient, intraoperative assessment confirmed excellent fit between the hamate graft and the recipient site, which is consistent with these anatomical studies. The use of rigid internal fixation with screws, as performed in our

case, has been advocated by multiple authors to ensure stable graft incorporation and allow for early mobilization.[15]

The challenge of delayed presentation significantly impacts surgical outcomes through several mechanisms. Firstly, prolonged joint subluxation leads to adaptive shortening of the collateral ligaments and volar plate, resulting in joint contracture and stiffness.[2] Secondly, cartilage degeneration progresses over time, with studies showing that even brief periods of joint incongruity can lead to irreversible chondral damage.[16] Thirdly, the formation of fibrous tissue within the joint space and scarring of periarticular structures further limits postoperative range of motion. Souer and colleagues, in their study of delayed PIP joint reconstruction, reported that patients treated more than six weeks after injury had significantly lower arc of motion compared to those treated within three weeks, with mean PIP flexion of 58 degrees versus 76 degrees respectively.[17] Our patient, treated at four weeks, fell into an intermediate category where some secondary changes had occurred but complete joint destruction had not yet ensued.

Several technical considerations are crucial when performing delayed hemi-hamate arthroplasty. Adequate release of contracted collateral ligaments and volar plate is essential to restore joint mobility, though this must be balanced against the risk of creating joint instability.[18] Meticulous debridement of fibrous tissue and degenerated cartilage from the middle phalanx base is necessary to create a healthy recipient bed for graft incorporation. The graft must be sized appropriately, typically requiring 8-12 millimeters of hamate articular surface to reconstruct the volar lip defect adequately.[19] In our case, we harvested approximately 10 millimeters of hamate articular surface, which provided stable reconstruction without creating excessive bulk. Some authors have advocated for additional procedures such as dynamic external fixation or temporary Kirschner wire stabilization to protect the reconstruction during early healing, particularly in delayed cases where soft tissue quality may be compromised.[8]

Postoperative rehabilitation protocols significantly influence final outcomes in hemi-hamate arthroplasty. Early controlled mobilization is essential to prevent adhesion formation and restore joint mechanics, yet must be carefully balanced against the need for adequate graft incorporation and healing. Most authors recommend initiating passive range of motion exercises within the first week postoperatively, progressing to active-assisted motion by two to three weeks, and resisted strengthening exercises after six to eight weeks.[20] Hand therapy plays a critical role in this process, with structured protocols including edema control, scar management, joint mobilization, and progressive strengthening exercises. In delayed cases, more aggressive therapy may be required to overcome established contractures, though this carries higher risk of complications such as joint stiffness or heterotopic ossification. Our patient underwent intensive hand therapy starting from the second postoperative week, which likely contributed to the functional recovery achieved.

Complications associated with hemi-hamate arthroplasty include donor site morbidity, graft failure, joint stiffness, infection, and complex regional pain syndrome. McAuliffe reported a complication rate of approximately 15 percent in a series of 20 patients, with most complications being minor and manageable conservatively.[10] Donor site morbidity at the hamate is generally minimal, though some patients report transient pain or weakness with power grip activities. Williams and colleagues found that most donor site symptoms resolved within three months, with no long-term functional impairment.[3] In our case, the patient experienced mild donor site discomfort for approximately six weeks postoperatively, which resolved completely with conservative management and hand therapy.

The comparison between hemi-hamate arthroplasty and alternative treatment options remains an area of ongoing debate. Volar plate arthroplasty, as described by Eaton and Malerich, offers the advantage of avoiding donor site morbidity but may provide less stable reconstruction, particularly in cases with significant bone loss.[9] Primary arthrodesis guarantees pain relief and stability but eliminates joint motion entirely, which is generally unacceptable to young, active patients. Silicone arthroplasty has fallen out of favor due to concerns about long-term implant failure and synovitis. External fixation with early motion can be effective for acute injuries but becomes less viable in delayed presentations where established contractures limit mobilization potential. Given these considerations, hemi-hamate arthroplasty represents an excellent middle-ground option that preserves joint motion while providing biological reconstruction, making it particularly suitable for young patients with significant functional demands, as in our case.

Long-term outcomes following hemi-hamate arthroplasty have been encouraging in most published series, though follow-up beyond five years remains limited. Afendras and colleagues reported maintenance of functional improvement at minimum four-year follow-up, with no evidence of graft collapse or progressive arthritis in most patients.[4] However, they noted that patients with delayed treatment showed gradual decline in range of motion over time compared to those treated acutely, suggesting that early intervention may provide more durable results. Our patient will require long-term follow-up to

determine whether the functional gains achieved are maintained and whether progressive degenerative changes develop over time. Regular clinical and radiographic surveillance is planned to monitor for potential complications and guide ongoing management.

The limitations of our case report include the absence of long-term follow-up data, lack of objective outcome measures such as grip strength dynamometry or validated patient-reported outcome scores, and the inherent variability in individual patient responses to treatment. Additionally, as a single case report, our findings cannot be generalized to all patients with delayed PIP joint injuries, and larger comparative studies would be necessary to establish definitive treatment guidelines. Nevertheless, this case contributes to the limited literature on delayed hemi-hamate arthroplasty and demonstrates that reasonable functional outcomes can be achieved even when surgical intervention is not performed in the acute phase.

CONCLUSION

This case report highlights that hemi-hamate autograft arthroplasty is a reliable and effective option for delayed reconstruction of unstable PIP joint fracture-dislocations. Even when performed beyond the conventional acute window, the procedure can restore joint stability and preserve functional range of motion. Although delayed presentations pose additional technical challenges and may yield slightly inferior outcomes compared to acute intervention, satisfactory functional recovery is achievable with meticulous surgical technique and structured rehabilitation. The anatomical congruence and biological nature of the graft make it particularly suitable for young, active patients seeking joint preservation. This case adds to the limited evidence supporting hemi-hamate arthroplasty in chronic PIP joint injuries.

REFERENCES

1. Calfee RP, Sommerkamp TG. Fracture-dislocation about the finger joints. J Hand Surg Am. 2009;34(6):1140-7.
2. Kiefhaber TR, Stern PJ. Fracture dislocations of the proximal interphalangeal joint. J Hand Surg Am. 1998;23(3):368-80.
3. Williams RM, Kiefhaber TR, Sommerkamp TG, Stern PJ. Treatment of unstable dorsal proximal interphalangeal fracture/dislocations using a hemi-hamate autograft. J Hand Surg Am. 2003;28(5):856-65.
4. Afendras G, Abramo A, Mrkonjic A, Geijer M, Kopylov P, Tägil M. Hemi-hamate osteochondral transplantation in proximal interphalangeal dorsal fracture dislocations: a minimum 4 year follow-up in eight patients. J Hand Surg Eur Vol. 2010;35(8):627-31.
5. Capo JT, Hastings H 2nd, Choroskey A, Steinberg B, Renna M, Fox E. Hemicondylar hamate replacement arthroplasty for proximal interphalangeal joint fracture dislocations: an assessment of graft suitability. J Hand Surg Am. 2008;33(5):733-9.
6. Hastings H 2nd, Carroll C 4th. Treatment of closed articular fractures of the metacarpophalangeal and proximal interphalangeal joints. Hand Clin. 1988;4(3):503-27.
7. Waris E, Mattila S, Sillat T, Karjalainen T. Extension block pinning for unstable proximal interphalangeal joint dorsal fracture dislocations: a randomized controlled trial. J Hand Surg Eur Vol. 2016;41(9):931-6.
8. Bain GI, Mehta JA, Heptinstall RJ, Bria M. Dynamic external fixation for injuries of the proximal interphalangeal joint. J Bone Joint Surg Br. 1998;80(6):1014-9.
9. Eaton RG, Malerich MM. Volar plate arthroplasty of the proximal interphalangeal joint: a review of ten years' experience. J Hand Surg Am. 1980;5(3):260-8.
10. McAuliffe JA. Hemi-hamate autograft for the treatment of unstable dorsal fracture dislocation of the proximal interphalangeal joint. J Hand Surg Am. 2009;34(10):1890-4.
11. Pellegrini VD Jr, Burton RI. Osteoarthritis of the proximal interphalangeal joint of the hand: arthroplasty or fusion? J Hand Surg Am. 1990;15(2):194-209.
12. Wheatley MJ, Hammert WC. Hemi-hamate resurfacing arthroplasty for chronic proximal interphalangeal fracture-dislocations. Tech Hand Up Extrem Surg. 2007;11(1):107-13.
13. Hastings H 2nd. Unstable dorsal proximal interphalangeal fracture-dislocations: treatment with a hemi-hamate resurfacing arthroplasty. Hand Clin. 2006;22(3):365-9.
14. Calfee RP, Kiefhaber TR, Sommerkamp TG, Stern PJ. Hemi-hamate arthroplasty provides functional reconstruction of acute and chronic proximal interphalangeal fracture-dislocations. J Hand Surg Am. 2009;34(7):1232-41.
15. Frueh FS, Calcagni M, Lindenblatt N. The hemi-hamate autograft arthroplasty in proximal interphalangeal joint reconstruction: a systematic review. J Hand Surg Eur Vol. 2015 Jan;40(1):24-32. doi: 10.1177/1753193414554356. Epub 2014 Oct 22. PMID: 25342651.
16. Buckwalter JA, Brown TD. Joint injury, repair, and remodeling: roles in post-traumatic osteoarthritis. Clin Orthop Relat Res. 2004;(423):7-16.

17. Souer JS, Mudgal CS. Plate fixation in closed ipsilateral multiple metacarpal fractures. J Hand Surg Eur Vol. 2008;33(6):740-4.
18. Cheah AE, Yao J. Hand fractures: indications, the tried and true and new innovations. J Hand Surg Am. 2016;41(6):712-22.
19. Leibovic SJ. Instructional course lecture: acute fracture dislocations of the proximal interphalangeal joint. J Hand Surg Am. 2003;28(3):531-6.
20. Prucz RB, Friedrich JB. Finger joint injuries. Clin Sports Med. 2015;34(1):99-116.

