CASE REPORT

Successful Reconstruction of Proximal Phalanx Condylar Fracture in an Athlete Using Auto-Osteochondral Graft from the Base of Fifth Metacarpus: A Case Report and Review of Literature

Meisam Jafari Kafiabadi, MD[1]; Amir Sabaghzadeh, MD[1]; Seyyed Saeed Khabiri, MD[1]; Adel Ebrahimpour, MD[1]; Farsad Biglari, MD[1]

Research performed at the Shohada-e Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Received: 24 November 2021 *Accepted: 13 February 2022*

Abstract

Intra-articular fractures of the proximal phalanx head, especially with the condylar defect, are relatively rare but challenging for surgical treatment. Although several surgical procedures are available to reconstruct articular cartilage defects, the optimal method is unclear. This study reports a successful osteochondral reconstruction of proximal phalanx condylar defect in an athlete using the articular portion of the fifth metacarpal base.

Level of evidence: V

Keywords: Bone transplantation, Finger phalanges, Intra-articular fractures

Introduction

Proximal interphalangeal (PIP) fractures are relatively common injuries that may lead to a limited range of motion and lack of distal dexterity.[1,2] Intra-articular fractures of the proximal phalanx head, especially with the condylar defect, are comparatively rare but challenging for surgical treatment.[2] Surgical methods to reconstruct articular cartilage defects include conventional arthrodesis, artificial joint replacement, and osteochondral transplantation.[2,3] A recently becoming popular method is using the dorsal portion of hamate bone to reconstruct comminuted middle phalanx volar base fractures.[4-6] Hernandez et al. introduced the base of the fifth metacarpus as a suitable donor site to reconstruct proximal phalanx condylar fractures.[7] Cavadas et al. reported acceptable functional outcomes in 16 cases of osteochondral reconstruction of proximal phalanx condylar fractures using the base of the fifth metacarpus as the donor site.[2] This study reports another successful acute osteochondral reconstruction of proximal phalanx condylar defect in an athlete using the articular portion of the fifth metacarpal base.

Case presentation

A 34-year-old male goalkeeper was admitted with an open injury of the non-dominant index finger due to an angle grinder accident in a non-sport event. On examination, there was a semi-circular laceration on the radial side of the left index finger at the PIP joint level with severe bone and soft tissue damages. Wound exploration was performed under digital block anesthesia in the emergency room, which confirmed the injury of radial digital neurovascular and flexor digitorum superficialis (FDS), flexor digitorum profundus (FDP), and extensor tendons [Figure 1]. Standard radiographs revealed a comminuted fracture of the distal part of the index finger with a condylar bone defect [Figures 2; 3]. After initial irrigation and dressing in the emergency room, the consent form was obtained from the patient, and then he was transferred to the operation room. Under axial nerve block anesthesia, crushed edges of wounds were

Corresponding Author: Farsad Biglari, Department of Orthopedic Surgery, Shohada-e Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran
Email: biglari.farsad@gmail.com

THE ONLINE VERSION OF THIS ARTICLE ABJS.MUMS.AC.IR

Figure 1. Photograph of left-hand index finger wound exploration revealed bone loss of proximal phalanx condyle, tendon, and neurovascular injuries.

trimmed, and irrigation was performed. Afterward, the semi-circular wound of the index finger was extended longitudinally towards the distal and proximal parts to provide better vision. Articular surface was exposed, and then debris and loose body fragments were removed. Afterward, the size of the condylar bone defect was estimated. The base of the ipsilateral fifth metacarpus was approached through a separated longitudinal dorsal incision. Extensor carpi ulnaris (ECU) tendon insertion was partially detached, and the condylar bone graft was harvested from the ulnar part of the fifth metacarpal base with an appropriate size. After the reattachment of the ECU tendon to the fifth metacarpal base, the donor site surgical wound was irrigated and closed. Margins of the fracture site were then trimmed with a mini-blade saw.

Furthermore, the condylar graft was trimmed with a mini-blade saw to be fitted in the defect site. Afterward, it

Figure 2. Preoperative anteroposterior radiograph of left hand demonstrated condylar defect of 2nd finger proximal phalanx.

Figure 3. Preoperative oblique radiograph of left hand demonstrated radial-sided condylar defect of 2nd finger proximal phalanx.

was fixed with two 1.3 mm screws in a proper position under fluoroscopy control. The FDP, FDS, and extensor tendons were then repaired meticulously, and the digital nerve was repaired anatomically with an end-to-end technique and under microscopic vision. The patient was discharged one day after surgery. On the 10^{th} postoperative day, the patient was visited, sutures were removed, and the passive motion of the PIP joint was allowed with a range of 0-45 degrees flexion. The passive range of motion was gradually increased by 15 degrees weekly, and the active movement started three weeks postoperatively. The patient was followed up for one year with monthly visits [Figures 4; 5]. He returned to sports activities six months postoperatively with a Total Active Motion of 92% and a visual analog scale of 0-1 [Figures 6; 7]. Moreover, he did not complain of the donor site on the last visit. The final sensory deficit

Figure 4. One-year postoperative oblique radiograph of left hand.

Figure 5. One-year postoperative anteroposterior radiograph of left hand.

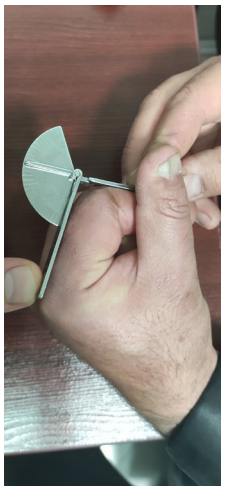

Figure 6. One-year follow up photograph – lateral view.

Figure 7. One-year follow up photograph – dorsal view.

was assessed one year postoperatively with a two-point-discrimination distance, which was 4 mm in both zones 1 and 2.

Discussion

The role of the PIP joint is a keystone of the hand function.[2] Therefore, the loss of its function could lead to dreadful clinical and functional outcomes.[2] Additionally, it would be significantly susceptible to traumatic events during daily activities.[8] In some cases, the severity of the injury is considerable enough to necessitate reconstructive procedures. Surgical methods for managing severe osteochondral damages to the PIP joint include conventional arthrodesis, artificial joint replacement, vascularized joint transfer, and autologous osteochondral transplantation.[2] Although conventional arthrodesis is a simple procedure for managing substantial chondral defects of the interphalangeal joint, it could result in a noticeable loss of motion in the affected joint.[2,3] The artificial joint replacement showed acceptable results in young, active patients; however, it may not be appropriate in trauma cases.[2] The vascularized joint transfer is a technically challenging procedure that should be selected only in few cases with both articular side defects.[2]

Previous studies demonstrated the optimal clinical and functional outcomes of Osteochondral Autograft Transplantation for managing chondral defects of the interphalangeal joints.[1-3,9] Osamu Ishida et al. used the distal or proximal side of the second or third ipsilateral carpometacarpal joint as a donor site for osteochondral transplantation.[3] They treated 10 patients with osteochondral defects in the distal or PIP joints with this method and reported an improved range of motion as much as 22 to 38 degrees in the affected joints. Kazuki et al. demonstrated that costal osteochondral transplant effectively treated chondral defects in the interphalangeal joints of the hand.[1] They recommended this method for patients younger than 50 years due to the possibility of degenerative changes in the costal cartilage. However, they mentioned that this procedure could also be helpful in patients aged above 50 without calcified costal cartilage. Keloid scar of the chest wall was noted as the single complication of this procedure.

Previously, several studies reported desirable outcomes of the reconstruction of PIP dorsal fracture-dislocation.[4-6] However, there is a lack of research on methods and clinical results of proximal phalanx condyle reconstruction. The base of the fifth metacarpus was identified as the best donor site for resurfacing distal condylar defects of the proximal phalange in a cadaveric study.[7] The ulnar side of the fifth metacarpal base anatomically resembles the condyle of the proximal phalanx. Cavadas et al. reported acceptable mid-term results of the proximal phalanx condyle reconstruction with the osteochondral graft from the ulnar base of the fifth metacarpus in 16 patients.[2] However, this technique is still not popular for managing condylar defects of the phalanx. Therefore, the functional outcomes of this technique in a high demanded patient, such as a goalkeeper, would be exciting and beneficial. Herein, the authors reported another successful acute

osteochondral reconstruction of proximal phalanx condylar defect in an athlete using the articular portion of the fifth metacarpal base. This surgery has the potential to be a safe and effective method for reconstructing the proximal phalanx condylar defect in young, active individuals with acceptable clinical and functional outcomes. Resorption of the bone graft is a well-known disadvantage of non-vascularized bone grafts even in autologous types.[10] In the current case, the one-year follow-up radiography revealed joint space narrowing and slight graft resorption; however, the final clinical outcomes were satisfactory [Figures 4; 5]. Seemingly, radiographic changes do not deteriorate the functional results.[11] Therefore, the current investigation has shown that this treatment can produce satisfactory results even when severe soft tissue injury occurs concurrently.

Management of condylar defect in proximal phalanx is challenging. Although there are several surgical techniques for treating these lesions, the optimal method has remained uncertain. The reconstruction of proximal phalanx condyle using an osteochondral autograft from the ulnar side of the fifth metacarpal base could be a helpful treatment method, especially in young and active patients.

Declaration of Conflicting Interests: The author(s) declared no potential conflicts of interest concerning the study, authorship, and/or publication of this article.

Meisam Jafari Kafiabadi MD[1]
Amir Sabaghzadeh MD[1]
Seyyed Saeed Khabiri MD[1]
Adel Ebrahimpour MD[1]
Farsad Biglari MD[1]
1 Department of Orthopedic Surgery, Shohada-e Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

References

1. Sato K, Nakamura T, Nakamichi N, Okuyama N, Toyama Y, Ikegami H. Finger joint reconstruction with costal osteochondral graft. Tech Hand Up Extrem Surg 2008;12(3):150-5. doi: 10.1097/BTH.0b013e31816d92ad.
2. Cavadas PC, Landin L, Thione A. Reconstruction of the condyles of the proximal phalanx with osteochondral grafts from the ulnar base of the little finger metacarpal. J Hand Surg Am 2010;35(8):1275-81. doi: 10.1016/j.jhsa.2010.04.013.
3. Ishida O, Ikuta Y, Kuroki H. Ipsilateral osteochondral grafting for finger joint repair. J Hand Surg Am 1994;19(3):372-7. doi: 10.1016/0363-5023(94)90048-5.
4. McAuliffe JA. Hemi-hamate autograft for the treatment of unstable dorsal fracture dislocation of the proximal interphalangeal joint. Journal of Hand Surgery 2009;34(10):1890-4. doi: 10.1016/j.jhsa.2009.08.017.
5. 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. doi: 10.1177/1753193410373311.
6. 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. doi: 10.1016/s0363-5023(03)00304-6.
7. Hernandez JD, Sommerkamp TG. Morphometric analysis of potential osteochondral autografts for resurfacing unicondylar defects of the proximal phalanx in PIP joint injuries. J Hand Surg Am 2010;35(4):604-10. doi: 10.1016/j.jhsa.2009.12.041.
8. Foucher G, Lenoble E, Smith D. Free and island vascularized joint transfer for proximal interphalangeal reconstruction: a series of 27 cases. J Hand Surg Am 1994;19(1):8-16. doi: 10.1016/0363-5023(94)90217-8.
9. Ozyurekoglu T. Multiple osteochondral autograft transfer to the proximal interphalangeal joint: case report. J Hand Surg Am 2010;35(6):931-5. doi: 10.1016/j.jhsa.2010.02.034.
10. Hirose H, Komura S, Hirakawa A, et al. Reverse radiodorsal artery-pedicled thumb metacarpal vascularized bone graft for osteochondral fracture of the thumb interphalangeal joint with a bone defect: A case report. Microsurgery 2021;41(2):170-4. doi: 10.1002/micr.30663.
11. Cavadas PC, Landin L, Thione A. Reconstruction of the condyles of the proximal phalanx with osteochondral grafts from the ulnar base of the little finger metacarpal. J Hand Surg Am 2010;35(8):1275-81. doi: 10.1016/j.jhsa.2010.04.013.