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## Case Report

## Forty-Two-Year Follow-Up After Heterodigital Vascularized Hemijoint Transfer: A Case Report



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Heterodigital vascularized hemijoint transfer can theoretically produce a near normal joint by combining intact joint components from different fingers and maintaining the joint space over the long term. We present herein an extremely rare case of heterodigital vascularized hemijoint transfer with a 42-year follow-up, demonstrating the longevity of this joint reconstruction technique for the restoration of hand function. Our patient's outcome indicates that despite the gradual progression of osteoarthritic changes, good subjective results and maintenance of an active range of motion can be acquired even after a long period. Technical factors such as graft fixation and the congruity of the articular surface may influence the gradual degeneration of joint surfaces.

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The use of tissues from an otherwise unsalvageable limb as “spare parts” represents the ultimate form of reconstruction during primary surgery.<sup>1,2</sup> However, some patients require secondary reconstructive surgery in which one good finger is produced from two partially destroyed fingers after initial wound care and healing is complete. This case report describes the 42-year follow-up of a vascularized hemijoint transfer procedure from two different fingers (heterodigital technique) with patient-reported outcome scores. The goal of this report was to highlight the longstanding functional and subjective benefits of this reconstructive method. The patient was informed that data concerning this case would be submitted for publication, and he provided consent.

## Case Report

A 24-year-old man sustained an injury while operating an industrial press. His middle finger was amputated through the middle phalanx, severely disrupting the metacarpophalangeal (MP) joints of the index and middle fingers. Ten months after initial care and healing of the wounds, the patient presented to our hospital for further functional recovery of the injured hand. The index finger

had normal interphalangeal joints and was functionally intact except for the MP joint, which had an extremely limited range of motion (ROM). The proximal interphalangeal joint of the middle finger was contracted in a flexed position, and the MP joint was stiff (Fig. 1). Radiographs showed palmar dislocation of the MP joint with a comminuted fracture of the base of the proximal phalanx of the index finger, destruction of the metacarpal head at the MP joint of middle finger, and malunion of the base of the proximal phalanx of the ring finger (Fig. 2). The patient underwent heterodigital hemijoint transfer from the metacarpal head of the index finger and the base of the proximal phalanx of the middle finger using a vascularized pedicle with the goal of attaining functional recovery of the injured hand.

The incision was similar to that used for index ray amputation. The index finger beyond the middle of the proximal phalanx combined with the metacarpal head was elevated with both the radial and ulnar neurovascular bundles, dorsal vein, extensor mechanism, and long flexor tendons in the index ray. Thus, the proximal half of the proximal phalanx of the index finger was removed. Conversely, the distal part from the middle of the proximal phalanx and metacarpal head was excised in the middle ray, whereas the proximal part of the proximal phalanx was preserved and remained attached to the ulnar neurovascular bundle. Intraosseous wiring was performed for fixation between the distal part of the proximal phalanx of the index finger and the base of the proximal phalanx of the middle finger. A Kirschner wire was passed transversely from the second to the fourth metacarpal head, and

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**Figure 1.** Preoperative photographs. **A** Palmar view. **B** Dorsal view.

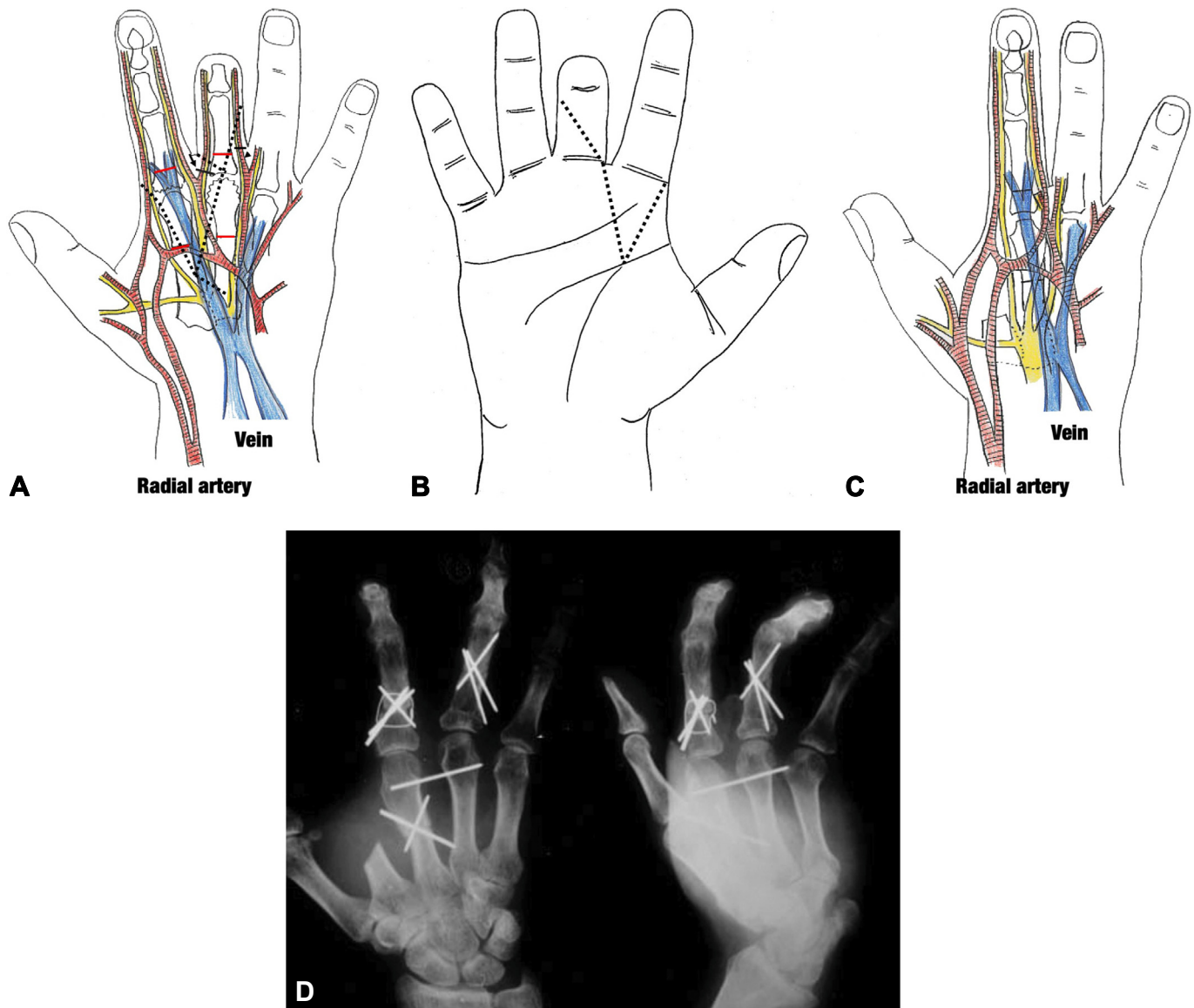


**Figure 2.** Preoperative radiographic images of the hand. **A** Posteroanterior and **B** oblique view X-ray images show palmar dislocation of the MP joint of the index finger (arrow) and destruction of the metacarpal head at the MP joint of the middle finger (arrowhead).

crisscross Kirschner wire fixation was performed between the second metacarpal head and the proximal part of the third metacarpus. Both the radial and ulnar collateral ligaments of the reconstructed MP joint in the third ray were repaired. Finally, osteotomy of the proximal phalanx of the ring finger was performed to correct the malunion of the proximal phalanx base (Fig. 3).

Active ROM hand therapy commenced 2 months after surgery. Eight months after surgery, X-ray examination showed mild

osteoarthritic (OA) changes, but active ROM was good, and the patient was pain-free (Fig. 4). Forty-two years after the heterodigital hemijoint transfer, he visited our hospital for his routine annual medical examination. He had continued his career as a factory worker until retirement 2 years previously. His extension deficit was 15° and active flexion was 65° in the reconstructed MP joint, and he reported no pain (Fig. 5). The average grip strength in the affected hand was 12.8 kg, whereas that in the unaffected hand was 32.1 kg. OA changes on X-ray images had gradually progressed



**Figure 3.** Schematic drawings of heterodigital hemijoint transfer. **A** and **B** Preoperative dorsal and palmar views. The incision was similar to that used in index ray amputation (dotted line). The index finger beyond the middle of the proximal phalanx combined with the metacarpal head was elevated with both the radial and ulnar neurovascular bundles and dorsal vein after severing the radial neurovascular bundle of the middle finger (arrow). The distal part from the middle of the proximal phalanx and metacarpal head was excised in the middle ray, but the proximal part of the proximal phalanx was preserved and remained attached to the ulnar neurovascular bundle (arrowhead). The red lines show the osteotomy sites. **C** and **D** Postoperative dorsal view and X-ray.

(Fig. 6); however, his Quick Disability of the Arm, Shoulder, and Hand Japanese Society for Surgery of the Hand questionnaire score<sup>3</sup> was 0 (no disability). He reported a high level of satisfaction with his secondary reconstruction.

### Discussion

This patient had an intact index finger with a poorly functional MP joint caused by palmar dislocation combined with damage to the proximal phalanx base. The base of the proximal phalanx of the middle finger was intact, although his middle finger was amputated through the middle phalanx with flexion contracture of the proximal interphalangeal joint and severe disruption of the MP joint due to the destroyed metacarpal head. We considered that a combination of intact components attached to neurovascular bundles could theoretically produce a

functional finger with a near normal MP joint while also shifting the index ray to the proximal part of the third metacarpus. This report describes the long-term outcome after vascularized heterodigital hemijoint transfer as a unique secondary reconstruction technique. Although the reconstructed MP joint gradually degenerated as shown in serial X-ray films, good clinical function and satisfactory subjective results persisted with no pain for a long period of time.

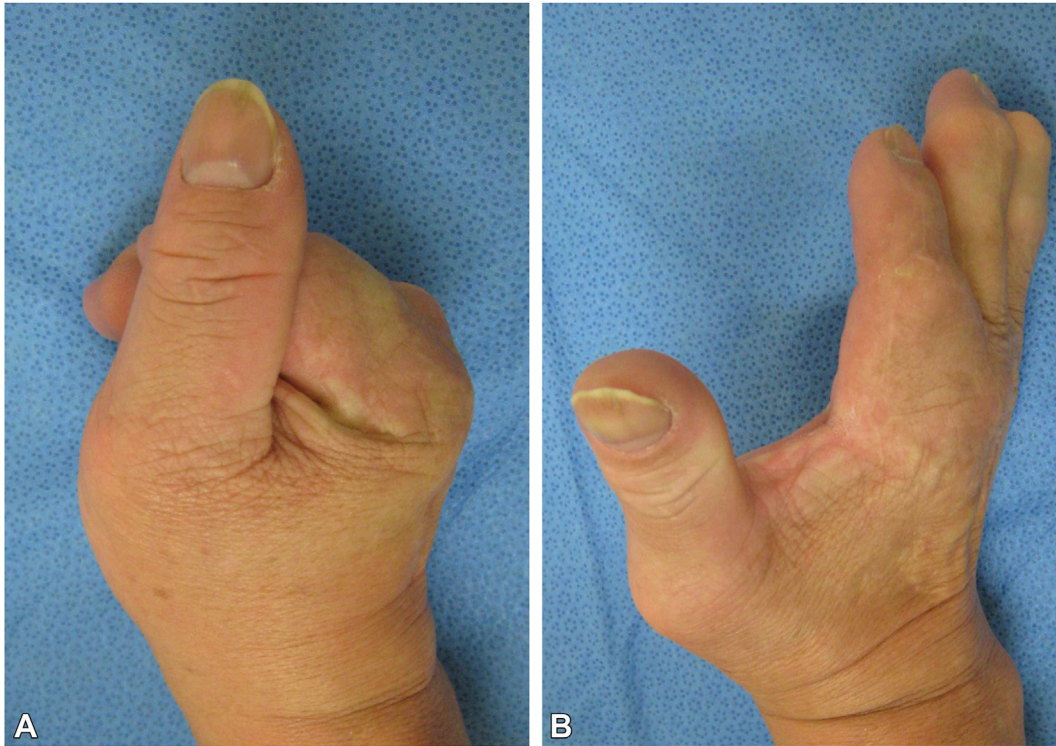
Free autogenous hemijoint and whole-joint transplantation have historically been unsuccessful because OA changes and joint destruction inevitably occur in the reconstructed joint.<sup>4</sup> Addition of a microvascular pedicle to the grafted joint improves the chance of successful joint transplantation.<sup>5</sup> Vascularized whole-joint transfers have demonstrated good long-term cartilage preservation both experimentally and clinically.<sup>5,6</sup> Although del Piñal<sup>7</sup> reported the use of a free vascularized toe phalanx graft for



**Figure 4.** Eight-month after surgery. **A** Active flexion. **B** Active extension. **C** Posteroanterior view X-ray demonstrating mild osteoarthritic changes (arrow) at the reconstructed joint.

reconstruction of a complex osseous defect of the joint as a hemijoint transfer, the long-term functional and X-ray findings are unknown. The outcomes of vascularized hemijoints are inferior to those of vascularized whole joints, probably for mechanical reasons.<sup>8,9</sup> In our patient, reasonably good function and high satisfaction remained for many years after the vascularized hemijoint

transfer; however, radiological signs of joint degeneration gradually increased. We believe that technical factors such as graft fixation and the congruity of the articular surface may influence the gradual degeneration of joint surfaces. The long-term radiological changes in the present case may have also been the result of the patient's extensive use of his hands as a factory worker.<sup>6</sup>



**Figure 5.** Active range of motion of the reconstructed middle finger at the final follow-up 42 years after surgery. **A** Active flexion. **B** Active extension.



**Figure 6.** X-ray at the final follow-up evaluation. **A** Posteroanterior and **B** oblique views showing gradual progression of osteoarthritic changes.

Several vascularized joint transfers have been reported for the reconstruction of destroyed joints. A free or pedicled vascularized whole joint was harvested from the second toe, the nonreplantable or nonfunctional finger (heterodigital technique), and the damaged finger itself (homodigital technique).<sup>2,5,6,10</sup> To our knowledge, however, a pedicled vascularized hemijoint transfer, either homodigital or heterodigital, has not been previously reported. We have presented an extremely rare case of heterodigital vascularized hemijoint transfer with a 42-year follow-up, demonstrating the longevity of this joint reconstruction technique for the restoration of hand function. Our patient's outcome indicates that despite the gradual progression of OA changes, good subjective results and maintenance of an active ROM can be acquired even after a long period of time.

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