# Pedicled Adipose Tissue for Treatment of Chronic Digital Osteomyelitis

Mitsuhiro Okada, MD, PhD, Masayuki Kamano, MD, PhD, Takuya Uemura, MD, PhD, Mikinori Ikeda, MD, Hiroaki Nakamura, MD, PhD

**Purpose** To describe a surgical technique (pedicled vascularized tissue transfer) for treating chronic digital osteomyelitis.

**Methods** Adipose tissue was obtained at the level of the proximal phalanx based on anterograde or retrograde flow. After bone debridement, we inserted the vascularized adipose tissue into the dead space. Eight patients were treated with this procedure from 2009 to 2012. One patient had chronic osteomyelitis in the thumb, 4 in the index finger, 2 in the middle finger, and 1 in the ring finger. Foci of chronic osteomyelitis were located at the distal phalanx in 2 patients, at the distal to middle phalanx across the distal interphalangeal joint in 4, at the middle phalanx in 1, and at the proximal phalanx in 1. Mean duration of follow-up was 41 months. We assessed the efficacy of the technique by clinical symptoms and imaging.

**Results** We used retrograde pedicled adipose tissue transfer in 7 patients and anterograde pedicled adipose tissue transfer in 1. The pedicled adipose tissue was successfully transferred from the digit tip to its base. The postoperative courses were uneventful; no additional treatments were required. Postoperative physical data and follow-up images showed no evidence of chronic osteomyelitis. No functional loss was caused by procuring vascularized adipose tissue from the digits.

**Conclusions** Pedicled vascularized tissue transfer based on the digital artery was a reliable and reproducible technique. We recommend it as a treatment option for chronic digital osteomyelitis. *(J Hand Surg Am. 2015;40(4):677–684. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.)*

**Type of study/level of evidence** Therapeutic IV.

**Key words** Chronic osteomyelitis, digit, pedicled tissue transfer, adipose tissue, digital artery.

VASCULARIZED TISSUE TRANSFER with antibiotic administration after excision of nonviable and infected bone improves local blood flow and antibiotic delivery and is an effective treatment for chronic osteomyelitis.[1] Vascularized tissue transfer for chronic digital osteomyelitis has been described only in various case reports.[2–5]

Pedicled vascularized tissue transfer is limited by a restricted arc of rotation: areas far from the vascular pedicle cannot be covered. Previously reported techniques for pedicled vascularized tissue transfer are adequate for chronic digital osteomyelitis proximal to the proximal interphalangeal (PIP) joint.[2,4] However, chronic digital osteomyelitis distal to the PIP joint requires a different type of pedicled vascularized transfer.

Free vascularized tissue transfer can be used for areas that cannot be reached by pedicled vascularized tissue transfer.[3,5] Unlike pedicled vascularized tissue

*From the Department of Orthopedic Surgery, Osaka City University Graduate School of Medicine; and the Department of Orthopedic Surgery, Takaishi Fujii Hospital, Osaka, Japan.*

Received for publication September 5, 2014; accepted in revised form December 19, 2014.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

**Corresponding author:** Mitsuhiro Okada, MD, PhD, Department of Orthopedic Surgery, Osaka City University Graduate School of Medicine, 1-4-3 Asahimachi, Abeno-ku, Osaka 545-8585, Japan; e-mail: m-okada@med.osaka-cu.ac.jp.

0363-5023/15/4004-0005$36.00/0
http://dx.doi.org/10.1016/j.jhsa.2014.12.034

**TABLE 1. Patients' Data**

| Patient | Age, y/Sex | Site of Injury | Etiology | Duration of Osteomyelitis, mo | Bony Defect* | Follow-Up, mo |
|---|---|---|---|---|---|---|
| 1 | 68/M | Distal to middle phalanx across DIP (R index) | Complication after surgical intervention | 2 | No | 59 |
| 2 | 57/F | Distal to middle phalanx across DIP (L middle) | Complication after surgical intervention | 3 | No | 55 |
| 3 | 80/F | Proximal phalanx (L index) | Cat bite | 1.5 | No | 52 |
| 4 | 52/M | Distal to middle phalanx across DIP (L index) | Unknown | 2.5 | No | 41 |
| 5 | 58/M | Distal to middle phalanx across DIP (R middle) | Burn | 1.5 | Yes | 40 |
| 6 | 75/M | Middle phalanx (R index) | Cat bite | 2.5 | No | 32 |
| 7 | 29/M | Distal phalanx (R ring) | Open fracture | 7 | Yes | 28 |
| 8 | 66/F | Distal phalanx (R thumb) | Unknown | 14 | No | 24 |

*Evaluated by plain radiography.

transfer, free vascularized tissue transfer requires vascular anastomosis, which risks arterial insufficiency and venous compromise of the transferred tissue. The risk of vascular compromise is even higher in cases involving treatment of infection.[6] From this viewpoint, pedicled vascularized tissue may have advantages in the treatment of chronic osteomyelitis.

We describe a surgical technique for covering foci of chronic digital osteomyelitis with a pedicled vascularized tissue transfer nourished by the digital artery.[7–12] In the current study, we assessed the efficacy of this technique based on clinical symptoms, imaging findings, and postoperative function and complications.

## MATERIALS AND METHODS

Our institutional review board approved this study and all patients gave written informed consent for their clinical data to be retrospectively reviewed. From November 2009 to October 2012, 8 consecutive patients were treated with pedicled adipose tissue transfer nourished by the digital artery for chronic digital osteomyelitis. Table 1 lists relevant patient variables. Five patients were men. Six had preexisting medical comorbidities such as diabetes, hyperlipidemia, hyperuricemia, hypertension, or hepatitis C. All patients had been unsuccessfully treated with antibiotics at other clinics. On admission to our clinic, patients' symptoms included localized pain, erythema, and swelling of the digits. The following organisms were cultured preoperatively from the wounds and intraoperatively from the debrided bone: *Staphylococcus epidermis*, methicillin-resistant *Staphylococcus aureus*, *Staphylococcus haemolyticus*, *Staphylococcus lugdunensis*, *Streptococcus agalactiae*, *Pasteurella multocida*, *Candida* spp., *Pseudomonas* spp., *Escherichia coli*, *Propionibacterium* spp., and *Corynebacterium* spp.

We used the following imaging findings to diagnose chronic digital osteomyelitis. Plain radiographs showed nonspecific periosteal reaction, osteolysis, or dense intramedullary cortical sequestra. In all patients with chronic osteomyelitis of the distal to middle phalanx across the distal interphalangeal (DIP) joint, plain radiographs showed articular destruction. Large bony defects without associated bony fistulas or joint erosion were present in 2 patients (cases 5 and 7). On magnetic resonance imaging (MRI), localized areas of abnormal bone marrow were detected as decreased signal intensity on T1-weighted images and increased signal intensity on T2-weighted images. Bone and gallium scintigraphy showed increased isotope uptake in the areas where MRI had shown abnormalities.[13]

The original injuries were an open fracture in 1 patient, secondary wound complications after surgical intervention in 2, cat bites in 2, a burn in 1, and unknown in 2. The time interval between the initial onset, defined as the inciting event, and our treatment ranged from 6 weeks to 14 months. The etiologies of cases 4 and 8 were clearly unknown; initial onset was defined as the time at which patients felt swelling of the affected digits. The corresponding author (M.O.) performed all surgeries. Average age at surgery was