Injury, Int. J. Care Injured 44 (2013) 1607–1614

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Reconstruction of a soft tissue defect in the finger using the heterodigital neurocutaneous island flap☆

Chao Chen [a,b,1], Peifu Tang [c,*], Lihai Zhang [c]

[a] Hand Surgery Department, The Second Hospital of Tangshan, Tangshan, Hebei 063000, PR China
[b] Affiliated Hospital of North China Coal Medical College (Hebei United University), Tangshan, Hebei 063000, PR China
[c] The Department of Orthopedics, The General Hospital of the People's Liberation Army, Beijing 100853, PR China

ARTICLE INFO

Article history:
Accepted 23 June 2013

Keywords:
Dorsal branch of the digital nerve
Dorsal digital artery
Dorsal digital island flap
Neurocutaneous island flap

ABSTRACT

Background: This article describes reconstruction of a soft tissue defect in the finger using the heterodigital neurocutaneous island flap and reports the results of the use of the flap.
Methods: From February of 2008 to March of 2011, the neurocutaneous island flap was used in 12 patients with soft tissue defects in the middle phalanx or the proximal interphalangeal joint, or both. The injured fingers included 4 index, 3 middle, 3 ring and 2 little fingers. The donor fingers included 7 middle fingers and 5 ring fingers. The mean size of soft tissue defects and the flaps was 2.4 cm × 1.8 cm and 2.7 cm × 2.0 cm, respectively. The mean pedicle length was 2.8 cm.
Results: Full flap survival was achieved in 11 cases. Partial distal flap necrosis was noted in one case, which healed without surgical intervention. At a mean follow-up of 22 months, the mean static 2-point discrimination and Semmes-Weinstein monofilament scores on the flap were 8.3 mm and 3.94, respectively. Based on the modified American Society for Surgery of the Hand guidelines for stratification of 2-point discrimination, 10 (83%) of 12 flaps achieved good results. According to the Michigan Hand Outcomes Questionnaire, 5 patients were strongly satisfied and 7 were satisfied with functional recovery of the reconstructed finger.
Conclusions: The neurocutaneous island flap of the dorsal branch of the digital nerve is useful, reliable, and technically easy for reconstructing a defect in the adjacent fingers, especially when sensory reconstruction is needed.

Introduction

The dorsum of the finger is a reliable flap donor site in reconstructive hand surgery owning to its similar skin quality to the original [1]. Being a useful and simple technique, the dorsal digital island flap (DDIF) [2] is frequently used for repairing the defect of adjacent finger. However, the limited pedicle length precludes its use for a more distal defect (Fig. 1) [3]. In such situation, the heterodigital neurocutaneous island flap, based on the dorsal branch of the digital nerve, can be used as an alternative to resolve this problem.

The dorsal digital flap, first described by Vilain and Dupuis in 1973 [4], is a sensate flag flap, which uses the dorsal skin of the proximal or middle phalanx to cover a volar defect of adjacent finger. In 2001, Yang et al. [3] modified the technique by removal of the skin bridge between the flap and the pivot point. The island flap receives its blood supply from the dorsal digital artery stemmed from the dorsal metacarpal artery, and is just used for reconstructing a defect proximal to the proximal interphalangeal (PIP) joint owning to its limited rotation arc (Figs. 2 and 3).

In 1998, Tellioglu and Sensöz [5] dissected 40 fingers from 8 cadavers and found that the dorsal branch of the digital nerve originated from digital nerve at the base of the proximal phalanx at which digital vascular bifurcation usually occurred. The nerve branch travels dorsally through the Cleland's band and usually gives off 3 terminal branches with regular distribution over the dorsum of the middle phalanx. This anatomical structure is the basis for our use of the flap for sensory reconstruction of a defect in the finger. In 2007, Zhang et al. [6] confirmed that the dorsal branch of the digital nerve was supplied by the small accompanying arteries. There is an interlacing vascular network between the small arteries and the dorsal branches of the digital artery (Fig. 4). The arterial system stimulates us to use a neurocutaneous island flap receiving its blood supply from the vascular network around the nerve branch (Fig. 5).

☆ ClinicalTrials.gov ID: NCT01778296.

* Corresponding author. Tel.: +86 13801379901.
E-mail addresses: ts_chenchao@163.com (C. Chen), tangpeifubeijing@163.com (P. Tang).
[1] Tel.: +86 03152058247; mobile: +86 13700350471.

0020–1383/$ – see front matter. Crown Copyright © 2013 Published by Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.injury.2013.06.025

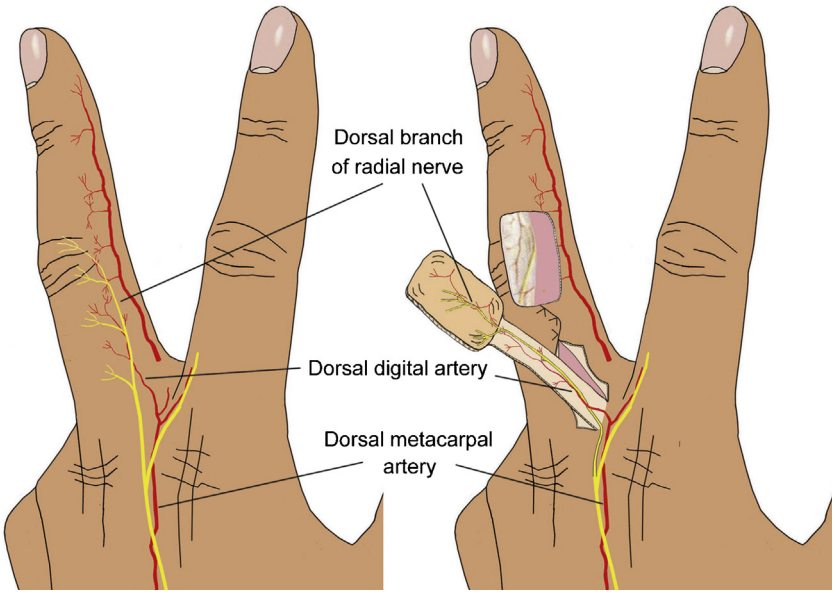

Fig. 1. The dorsal skin of the proximal phalanx and proximal interphalangeal joint is supplied by terminal dorsal branches of the radial nerve (left). The dorsal digital island flap receives its blood supply from the dorsal digital artery stemmed from the dorsal metacarpal artery. The terminal dorsal branch of the radial nerve is included in the flap (right).

The purpose of this study is to report on reconstruction of the soft tissue defect of adjacent finger using a neurocutaneous island flap of the dorsal branch of the digital nerve. We also describe our results of a series of 12 patients treated with this technique.

Patients and methods

This study was approved by the institutional review boards of the participating hospitals. Informed consent and Health Insurance Portability and Accountability Act consent were obtained from each patient.

From February of 2008 to March of 2011, 12 patients with soft tissue defects on the middle phalanx or PIP joint, or both, were treated with the neurocutaneous island flap. The patients included 9 men and 3 women, with an average age of 35 years (range, 18–51 years). The causes of the defects were traumatic avulsion in 5 patients and crush in 4 patients and digital scar excision in 3 patients (Table 1). The injured fingers included 4 index, 3 middle, 3 ring and 2 little fingers. The donor fingers included 7 middle fingers and 5 ring fingers. The size of the defects ranged from 1.7 to 3.2 cm long and 1.5 to 2.1 cm wide. The flaps ranged in size from 1.9 cm × 2.0 cm to 3.4 cm × 2.2 cm (mean, 2.7 cm × 2.0 cm). The mean pedicle length was 2.8 cm (range, 2.2–3.8 cm). The surgical procedures were emergently conducted in 9 patients, whereas the procedures were performed for treatment of the digital scar contracture in 3 cases. The average time to perform the procedure was 1.5 h (range, 1.2–2.5 h).

The patients were required to meet the following criteria: (1) a soft tissue defect on the middle phalanx or PIP joint, or both; (2) a defect greater than or equal to 1.5 cm in length; and (3) a patient

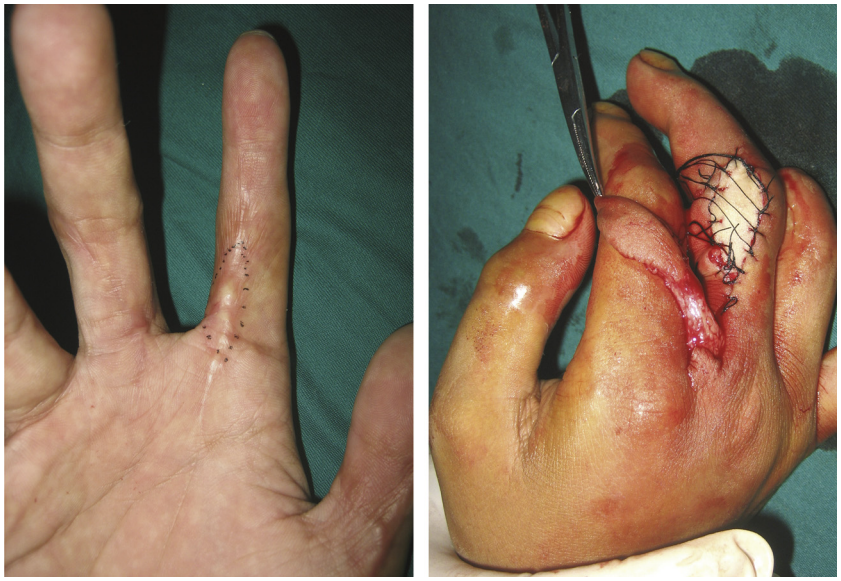

Fig. 2. The scar contraction of the proximal phalanx of the index finger (left). A dorsal digital island flap was harvested from the dorsum of proximal interphalangeal joint of adjacent middle finger (right).