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Functional and aesthetic outcomes of the fingertips after nail lengthening using the eponychial flap☆

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Summary *Introduction:* Eponychial flap technique is able to lengthen the visible nail and allow the preservation of the nail complex following fingertip amputations with nail bed involvement. The study assessed the functional and aesthetic outcomes of the reconstructed fingertips using the eponychial flap.
Methods: Eponychial flaps were performed in 11 fingertip amputations. Two-point discrimination, light touch, Purdue dexterity test, and pinch power of the reconstructed digits were examined. Patient-reported outcomes including subjective pain, Michigan Hand Outcome Questionnaire, and visual analog scale for appearance were documented. For comparison, nine patients with similar fingertip amputations treated by stump revision and nail bed ablation were included.
Results: The average length of the visible nail beds of the injured digits was 33.3% compared with the contralateral normal nail beds. The eponychial flap could lengthen the nail beds by an average of 32.4% of the length of the contralateral side. The mean follow-up was 26 months. Patients treated using the eponychial flap had greater pinch power of the reconstructed digits, higher satisfaction, and better aesthetic results when compared with patients receiving stump revision and nail bed ablation. There were no significant differences between two groups in sensation and Purdue dexterity test. Patient satisfaction was correlated with the reconstructed nail length.
Conclusion: The eponychial flap is a simple and safe technique that can restore the functional and aesthetic fingertip in selected distal phalanx amputations. The aesthetics, pinch power, and patient satisfaction are significantly better with fingernail preservation and elongation using the eponychial flap.

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Introduction

Fingernails occupy the dorsum of the terminal 25—50% of the distal phalanx. The fingernail is important for the aesthetic appearance and pulp stability. It aids the hand to manipulate and pick up fine objects, enhances fingertip perception by acting as a counterforce to the finger pad, and serves as a rigid protection for the sensate fingertip.[1]

The frequent involvement of the nail bed in distal fingertip amputations complicates reconstruction and influences the choice of treatment. Sommer and Brown suggested that if >25% of the nail bed distal to the eponychium is present, the patient may benefit from maintaining the nail, and if <25% remains, the resection of the nail bed is recommended.[2] Fassler stated that if the nail bed is <5 mm, the nail bed should be ablated and revision amputation performed.[3]

Bakhach first presented the eponychial flap in 1998.[4] The eponychium covers the nail root, which represents 40% of the length of the visible nail bed.[4] During the procedure, the eponychium is plicated backward after deepithelization of a small rectangular area proximal to the flap border, thus exposing the underlying nail root and lengthening the visible nail bed. The blood supply of the flap comes from numerous longitudinal arterial branches from the dorsal distal arch.[1] Bakhach and Adani reported satisfactory cosmetic results using eponychial flap in distal fingertip amputations.[5,6] Xing et al. suggested its application in whom the residual nail bed was >2 mm or the lunula was intact,[7] and Fakin et al. found it to be effective even for injuries proximal to the lunula.[8] However, these studies were concerned mainly with the aesthetic results, but they did not focus on the function of the reconstructed digits.

In this study, the authors comprehensively assessed the functional and aesthetic outcomes of the fingertips after nail lengthening using the eponychial flap. Statistical analysis was used to compare the outcomes of the eponychial flap to that of revision amputation in fingertip amputations involving the proximal nail bed.

Patients and methods

Study design

The study was approved by the Chang Gung Medical Foundation Institutional Review Board (103-3126B). Written informed consent was obtained from each adult patient and from a parent or a guardian of the patient if he or she is under the age of 18. Patients in the study group were selected on the basis of the following: (1) a fingertip amputation through the proximal half of the visible nail bed; (2) the preservation of the eponychium and germinal matrix; and (3) the absence of medical and neurological disorders that may interfere with the examinations.

Demographic data were recorded, including the visible nail bed length of the injured digits and the length of the amputated distal phalanges measured from preoperative plain radiographs. The length of the nail bed and bone of the injured digit were expressed as a percentage of that of the contralateral healthy digit. Intraoperative details including the extent of nail bed lengthening, the length of bone shortening, and the types of local flaps used for pulp reconstruction were documented.

Operative techniques

After the surgical procedure for fingertip reconstruction was complete, the nail complex defect was evaluated and compared with the contralateral fingernail. The eponychium was detached along its entire width using a fine elevator. The length of the nail root was measured to assess the potential backward movement of the flap. Two full-thickness longitudinal cuts were carried out from the lateral edge of the eponychium to the proximal end of the nail root. Two small back-cuts were made into the paronychium to facilitate flap transposition and fixation. Deepithelization was unnecessary in our modified technique. The flap was plicated backward, and it was fixed to the paronychium by simple interrupted sutures (Figures 1 and 2). Compression bandage was used for the dorsal bulge after suture removal, and it was continued for 3 months (Figure 3).

Objective outcome measures

All aesthetic and functional outcomes were assessed by a single examiner (HYC), who had not been involved in any of the cases. At the final follow-up, both the reconstructed digits and the contralateral healthy digits were examined. Plain radiographs were taken for both hands. The length of the visible nail bed and the whole digit was measured. Sensation of the pulp was assessed using static and dynamic two-point discrimination (2PD) and Semmes—Weinstein monofilament (SWM) test. Purdue Pegboard Test (North Coast Medical, Inc., Gilroy, CA, USA) was used to evaluate the fine manual dexterity of the hand. The test included removing pins from a tray and placing them into a pegboard by each hand, and assembling a combination of pins, washers, and collars with both hands. The results were adjusted for gender, and they were given a four-point scale: 1 = excellent, 2 = good, 3 = fair, and 4 = poor. The power of tip pinch was measured by Exacta™ Hydraulic Pinch Gauge (North Coast Medical, Inc., Gilroy, CA, USA), and the data were adjusted for a 13% difference between the dominant and nondominant hand according to the study of normal Taiwanese adults by Su et al.[9] The tip pinch was performed with the tip of the tested digit against the thumb. When the thumb was involved, the test was done with the thumb against the tip of the index finger. For the nail length, digit length, and adjusted pinch power, the