

## Secondary Intention Healing After Functional Surgery for *In situ* or Minimally Invasive Nail Melanoma

Gwanghyun JO<sup>1#</sup>, Keunyoung HUR<sup>1#</sup>, Soo Ick CHO<sup>1</sup> and Je-Ho MUN<sup>1,2\*</sup>

<sup>1</sup>Department of Dermatology, Seoul National University College of Medicine, 101 Daehak-ro, Jongno-gu, 03080 Seoul, and <sup>2</sup>Institute of Human-Environment Interface Biology, Seoul National University, Seoul, Republic of Korea. \*E-mail: jehomun@gmail.com

<sup>#</sup>These authors contributed equally to this work.

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Nail melanoma (NM) is a rare subtype of cutaneous melanoma of the nail unit (1, 2). Previously, amputation was considered the treatment of choice regardless of disease stage (3). However, recent studies have shown that conservative surgery has excellent oncological, functional, and cosmetic outcomes for NM *in situ* (NMIS) or minimally invasive (Breslow thickness  $\leq 0.5$  mm) NM (MINM) (3, 4). Functional surgery requires excision of the nail unit with at least 5-mm margins. Owing to the limited skin reservoir in the nail unit, surgical defects cannot be closed using primary closure. To date, various reconstructive methods, including local flap, free flap, full-thickness skin graft (FTSG), and secondary intention healing (SIH) have been reported.

SIH is a good method for NM without the need for sophisticated reconstructive procedures and loss of donor tissues (5, 6). The main limitations of SIH are concerns about infection and long healing time. However, to our knowledge, there are no detailed data in the literature about the recovery time and outcomes of SIH. This information is relevant to surgeons as well as patients with impeding surgery with NM. Therefore, this study aimed to evaluate the healing time, functional and cosmetic outcomes, postoperative complications, and subjective patient satisfaction of SIH after conservative surgery for NM.

### MATERIALS AND METHODS

Patients who underwent functional surgery with pathologically confirmed SIH for NMIS or MINM at our institution from 2015 to 2018 were included in the study. This study was approved by the institutional review board (IRB number 1807-174-963).

Total excision of the nail unit was performed with 5-mm free margins. The safety margin was calculated from the lateral nail folds, hyponychium, and nail matrix. When Hutchinson sign was present, the margins were measured from the pigmentation. The total nail unit including the periosteum was excised, as the distance between the matrix or nail bed and the phalangeal bone is generally short ( $<1$  or 2 mm). Extreme caution was applied during incision at the proximal margin to preserve the extensor hallucis longus tendon. After excision, paraffin tulle coated with chlorhexidine was applied (Bactigras<sup>®</sup>; Smith & Nephew, London, UK) and multiple layers of sterile gauze. Peha-haft<sup>®</sup> (Paul Hartmann, Heidenheim an der Brenz, Germany) was used for compressive dressing. Cephadrine (500 mg, 4 times daily for 3–7 days) with either acetaminophen (650 mg, 3 times daily) or aceclofenac (100 mg, 2 times daily for  $\geq 1$  week) were prescribed to the patients. The dressings were changed 3 times weekly. After granulation tissue had completely covered the phalangeal bone, weekly dressing changes were performed at our department and the patients were educated about changing their dressings at home. After complete re-epithelialization, the patients stopped applying dressings and used Vaseline as emollient.

To evaluate the healing process photographs were taken weekly. During the visit patients were assessed for early postoperative complications (infection, bleeding) and late complications (nail spicules, sensory change, limited extension, recurrence).

Time to coverage of the phalangeal bone by granulation tissue without bare areas (T1) and time to re-epithelialization (T2) were assessed. The functional outcome, cosmetic outcome, and subjective satisfaction were evaluated in the outpatient clinic during the follow-up or through a phone call on 20 July 2019. Functional outcome was evaluated using the Quick-Disabilities of the Arm, Shoulder, and Hand (DASH) measure for finger lesions (score 0–100) and the Foot Function Index (FFI) for toe lesions (score 0–230). Both tools are objective and well validated for functional evaluation of the hand and foot (7, 8). Cosmetic outcome was evaluated using the Vancouver Burn Scar Assessment Scale (VBSAS) (9). Patients were asked to rate their subjective global satisfaction as NRS score (range 0–10). After informing the patients that amputation was an alternative treatment option, they were asked to provide their satisfaction rating again.

Descriptive statistics (mean, standard deviation, median, range) were obtained. All statistical analyses were performed using SPSS 22.0 software (IBM, Armonk, NY, USA).

### RESULTS

A total of 12 patients were evaluated. Eleven patients had NMIS and one patient (patient 9) had MINM (Breslow thickness 0.2 mm). Median age was 51 (range 28–69) years. Eight patients were women (75%). The median follow-up period was 19 (range 7–27) months. The patients' clinical information is detailed in Table S1<sup>1</sup>.

After en-bloc nail excision, granulation tissue covered the entire phalangeal bone without bare areas at a mean of  $4.2 \pm 2.3$  (range 2–9) weeks. Re-epithelialization was completed at a mean of  $10.6 \pm 2.8$  (range 5–15) weeks (**Fig. 1**).

Quick-DASH scores were evaluated in 9 patients. Mean Quick-DASH score was  $11.6 \pm 7.1$ . The mean time of Quick-DASH evaluation was  $15.5 \pm 6.3$  weeks postoperatively. Three patients reported more than mild difficulty for items 1, 2, 5, 6, and 8. FFI scores were evaluated in 3 patients. The mean time of FFI evaluation was  $12.3 \pm 0.6$  weeks postoperatively. Two patients felt no discomfort resulting from the surgery in their daily life. The remaining patient gave 1 point for walking 4 blocks, 1 point for standing tip toe, and 2 points for walking fast. The mean total VBSAS score was  $4.6 \pm 1.3$ . The score for pliability was rather high ( $2.4 \pm 0.8$ ), whereas the other mean scores were  $< 1.0$ .

<sup>1</sup><https://www.medicaljournals.se/acta/content/abstract/10.2340/00015555-3541>



**Fig. 1.** Course of secondary intention healing after en-bloc excision of the nail unit. (a) Subungual melanoma in situ. (b) Postoperative photograph after functional surgery. (c) Partial granulation tissue covering the phalangeal bone (2 weeks). (d) Granulation tissue completely covering the phalangeal bone (4 weeks). (e) Complete re-epithelialization (7 weeks). (f) Follow-up (12 months).

With respect to acute postoperative complications, bleeding over the compressive dressing was observed in one patient, which was controlled by electrocauterization of the vessels and use of compressive dressing. Tinea pedis was found in one case (case 3 at week 4), which was resolved using a topical anti-fungal agent. Concerning delayed complications, nail spicules occurred in 3 patients (25%), sensory change in 4 patients (33%), and extension limitation in 2 patients (17%). Local recurrence was detected 8 months after surgery in one case (8%) that initially had wide ill-defined Hutchinson signs. It was treated with re-excision.

The subjective global satisfaction with respect to the surgical outcome was high (mean NRS score  $8.4 \pm 1.0$ ). The reassessed subjective global satisfaction after informing the patients that amputation was an alternative treatment option was higher (mean  $9.7 \pm 0.8$ ) ( $p=0.011$ , Wilcoxon signed-rank test).

## DISCUSSION

These results suggest that SIH after conservative surgery for NM leads to acceptable re-epithelialization time as well as good functional and cosmetic outcomes without serious complications. Moreover, the patients reported high subjective satisfaction.

Various reconstructive surgeries for NM have been reported, such as local flaps, including cross-finger flap, free flap, FTSG, and SIH (10–12). Except for SIH, the other techniques necessitate donor tissues. Therefore, subsequent surgical complications, such as graft/flap loss can occur. In contrast, SIH has the advantages of simplified wound management, avoidance of sophisticated reconstructive procedures, no donor defect, more natural granulation tissue, and optimal cancer surveillance (13). In addition, SIH may provide better cosmetic outcome with less hyperpigmentation than FTSG (6). A recent survey assessing patient outcome after digit-sparing conservative surgery of NM *in situ* revealed a high overall satisfaction score (14). Considering the mean DASH score of 31.3 after ter ray amputation and 21.7 after digit amputation (15), the

current study revealed a better score, with a mean of  $11.6 \pm 7.1$  after functional surgery with SIH.

This study has some limitations. First, the number of patients was small. Secondly, this study does not provide direct comparisons of various surgical techniques. Randomized controlled trials with large sample sizes are needed. Thirdly, additional novel materials, such as artificial dermis to facilitate the healing process have not been used in the current study. Further studies are necessary to investigate whether the use of an artificial dermis expedites the regeneration process after total excision of the nail unit.

In conclusion, these data suggest that SIH is a good reconstructive method for the defect after conservative surgery for NM, with acceptable re-epithelialization time, excellent functional and cosmetic outcomes, and high patient satisfaction.

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