# Modified shave surgery combined with nail window technique for the treatment of longitudinal melanonychia: Evaluation of the method on a series of 67 cases

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***Background:*** Nail matrix histopathologic examination is still the criterion standard to diagnose longitudinal melanonychia (LM).

***Objective:*** To introduce modified shave surgery combined with the nail window technique for managing LM and evaluate the postoperative outcome of the procedure.

***Methods:*** We retrospectively reviewed the medical records of 67 patients with LM who underwent shave surgery combined with the longitudinal-strip nail window technique at our institution from March 2015 to June 2018.

***Results:*** Pathologic diagnosis was accessible in all cases, and 60 cases were assessable for the postoperative outcomes. A total of 45 cases (75.0%) had no postoperative nail dystrophy, and recurrence of nail pigmentation was found in only 8 cases (13.3%).

***Limitations:*** This was a retrospective study.

***Conclusion:*** Modified shave surgery combined with the nail window technique is the preferable management for LM cases, with limited postoperative nail dystrophy and recurrence of pigmentation. (J Am Acad Dermatol 2019;81:717-22.)

***Key words:*** longitudinal melanonychia; nail dermoscopy; nail melanoma; nail surgery; nail window technique; onychoscopy; shave surgery; tangential excision; treatment.

Longitudinal melanonychia (LM) could be the first sign of nail melanoma; therefore, diagnosing it at an early stage is most crucial. The ABCDEF (age, band, change, digits, extension of pigment, and family history of melanoma) rule for evaluation of LM can be a helpful starting point for clinical detection of subungual melanoma.[1] It is, however, more applicable to lesions in later stages, and the value for early diagnosis is relatively limited. Onychoscopy, or nail dermoscopy, is useful in better observing subtle morphologic features.[2] It is a potential link between naked eye examination (clinical onychology) and nail histopathology. Nail melanoma may display bands with a brown-black

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Funding sources: Supported by the National Natural Science Foundation of China (grants 81000703 and 81472896), Natural Science Foundation of Jiangsu Province (grant BK2009437), and Six Talent Peaks of Jiangsu Province (grant 2015-WSW-026).
Conflicts of interest: None disclosed.
Accepted for publication March 22, 2019.

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Published online March 28, 2019.
0190-9622



https://doi.org/10.1016/j.jaad.2019.03.065

background, irregular lines of color, irregular thickness, and uneven spacing.[3] Though our knowledge in the field of onychoscopy is rapidly advancing, it remains in its infancy owing to a lack of controlled studies establishing the sensitivity or specificity of onychoscopic diagnostic criteria.[2,4]

Heretofore, histopathologic examination is still the criterion standard to diagnose LM and exclude the possibility of nail melanoma.[5] Owing to the unique anatomic structures of the nail unit, invasiveness of the procedures, and possible postoperative complications, most dermatologists are reluctant to perform nail matrix surgery. Shave surgery is a split-thickness nail matrix biopsy technique that removes only the matrix epithelium and a thin layer of the underlying dermis.[6] The procedure is now increasingly being recognized as a preferred surgical approach because of its low risk of severe permanent nail dystrophy, especially for those lesions that eventually prove to be benign.[7-9] The nail window technique assisted by a $CO_2$ laser is an auxiliary method before nail surgery that creates a window on the nail plate and makes exposure of the pigmented nail matrix easier.[10]

**CAPSULE SUMMARY**

- Modified shave surgery combined with the longitudinal-strip nail window technique facilitates the procedure and lowers the postoperative onychodystrophy and recurrence of pigmentation effectively.
- To our knowledge, this is the largest case series to evaluate the postoperative outcome of shave surgery.

A previous study has shown that the rate of recurrence of nail pigmentation was as high as 70% after tangential excision of pigmented nail matrix lesions responsible for LM.[8] This may due to an incomplete excision of the responsible lesions or repopulation of the melanocytes from the ventral surface of the pigmented nail plate. For the previous study, there was no attempt to remove this portion of the melanocytic lesion completely before putting the nail plate back, and potential activated melanocytes may have been left behind. In this regard, our study adopted modified shave surgery combined with a longitudinal-strip nail window technique for managing uncertain cases of LM and evaluated the postoperative outcome of the procedure. Herein, we present some modified tips regarding the procedure to reduce the rate of nail repigmentation.

## METHODS

### Clinical data

We selected patients with acquired LM who were seen at the Department of Dermatology of the First Affiliated Hospital with Nanjing Medical University from March 2015 to June 2018, with the exclusion of patients with non–melanin-derived melanonychia, such as subungual hemorrhage or onychomycosis. The following clinical features were recorded: age, sex, and location of the affected nail(s); color and width of the band; and whether pigmentation was present on the nailfold or hyponychium (the Hutchinson sign). The study was approved by the ethics committee of First Affiliated Hospital with Nanjing Medical University, Nanjing, China. Informed consent was obtained from each patient.

### Dermoscopic examination

Each pigmented band on the nail plate was routinely examined by dermoscopy (Dermlite DL3, 3Gen, San Juan Capistrano, CA). According to the typical onychoscopic manifestations,[11,12] we roughly divided the cases of LM into 3 groups based on presence of the following patterns: regular gray pattern, regular brown-black pattern, and irregular brown-black pattern. Regular gray pattern refers to a grayish background of the band with or without the presence of thin longitudinal gray lines with regular thickness, spacing, coloration, and absence of parallelism disruption. Regular brown-black pattern implies bands with a brown-black background, with regular parallel lines of identical color, spacing, and thickness. Irregular brown-black pattern appears as a more dark background, with varying spacing and thickness, and evidence of crossing over of lines. Beyond all that, the micro-Hutchinson sign and dots/globules of pigment,[13] which are more likely presented in nail melanoma, were also inspected and recorded.

According to the clinical and demoscopic examination, the complete exclusive criteria of LM cases were as follows: (1) ulcer and the Hutchinson sign on the nailfold or hyponychium, (2) extremely irregular patterns detected with or without the micro-Hutchinson sign or dots/globules of pigment under dermoscopy in LM patients older than 30 years, and (3) personal history of melanoma or other malignancies.

### Window technique

After surgical disinfection with 10% povidone-iodine, proximal digital block was administered in the digit to be operated on. Then, a tailored rectangular window with a distance of 2 mm from

*Abbreviation used:*

LM: longitudinal melanonychia

the lateral margin of the pigmented band was made by a $CO_2$ laser (AcuPulse 40AES-F, Lumenis Ltd, Germany; setting, 3-5 W, continuous mode) (Fig 1). Note that only several seconds were required to make a partial or complete cut in the nail plate and prevent the thermal damage of the underlying nail bed and matrix. Subsequently, the laser-cut nail plate was gently incised by using a no. 15 scalpel blade (disposable surgical blade, Huawei, China). With removal of the pigmented nail plate, the pigmented nail bed and matrix were preliminarily exposed.

### Modified shave surgery

To maintain a bloodless operative field, a tourniquet was applied at the base of the digit. Then, 2 lateral incisions at the junction between the proximal and lateral nailfolds were made to separate the proximal nailfold from the dorsal surface of the nail plate and expose the entire pigmented lesion responsible for the LM (Fig 2). The no. 15 blade used to make a shallow incision with a safety margin of 1 to 2 mm was carried around the pigmented nail matrix. Afterward, the scalpel was held horizontally and shave excision was performed by tangential sawing motions until the specimen was completely free. This yielded a specimen that was less than 0.5 mm thick and needed to be put on a piece of wet filter paper to remain flat. Together with the filter paper, the specimen was then immersed into 10% formalin and sent for histopathologic examination. Note that any pigmented lesion extending from the distal matrix onto the nail bed should be removed together with the matrix lesion as a single specimen.

The ventral surface of the excisional nail plate, which is sometimes attached to matrix epithelium, should be carefully scraped by using a no. 15 blade and then returned to its original position as a physiologic dressing. Finally, the proximal nailfold should be sutured.

A follow-up at regular intervals was performed until complete regrowth of the nail plate occurred. Long-term complications of the procedure, including permanent nail dystrophy, dorsal pterygium, and recurrence of nail pigmentation, were evaluated when follow-up data were available. When this information was unavailable, we contacted the patients via social media and asked for photographs of the surgical site to check the occurrence of complications.

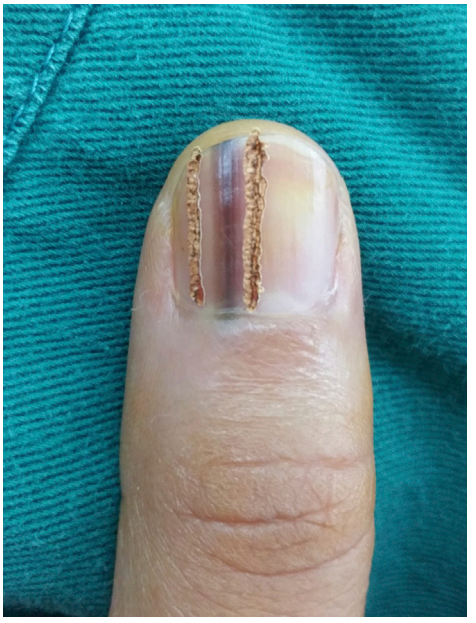

**Fig 1.** Longitudinal melanonychia. The pigmented nail plate is cut by using $CO_2$ laser with a 2-mm safety margin from the lateral border of the pigmented band (case 64).

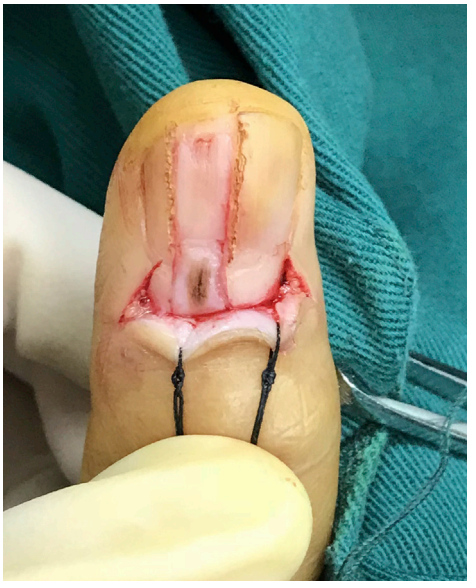

**Fig 2.** Longitudinal melanonychia. The pigmented lesion is exposed after removal of the laser-damaged nail plate and reflection of the proximal nailfold (case 64).

### Results

A total of 67 patients with acquired LM (24 males and 43 females), aged 4 to 70 years (mean age, 36 years), were included in the study. The LM was located on a fingernail in 59 cases and on a toenail in 8 cases, in which the most common location was the thumb (29 cases). The width of the pigmented band ranged from 1 to 8 mm. Of the 67 pigmented bands,

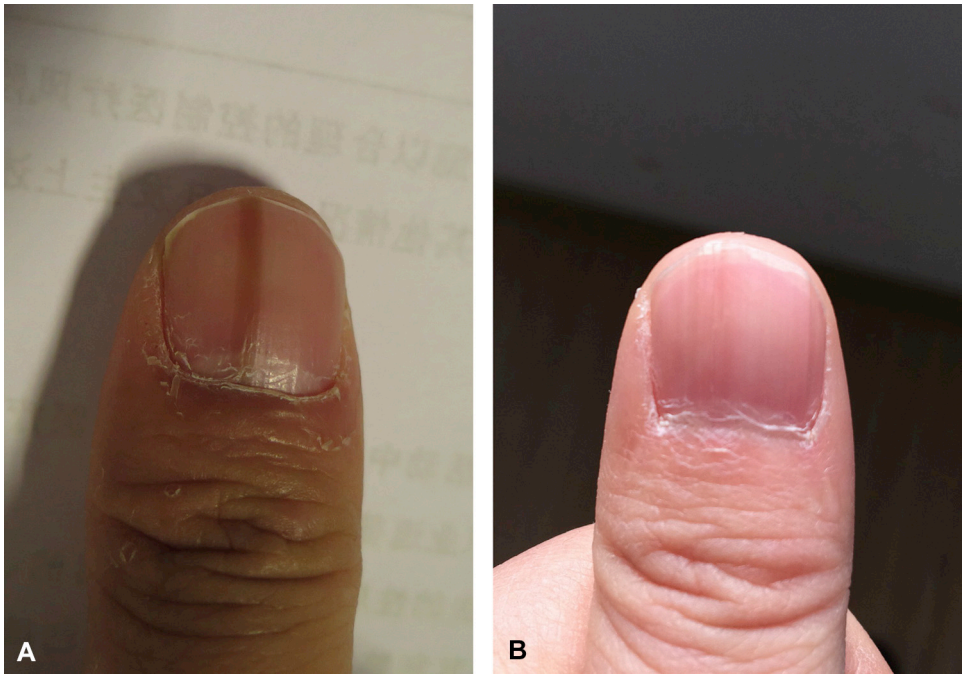


**Fig 3.** Longitudinal melanonychia. **A**, Preoperative aspect of LM. **B**, Postoperative outcome of shave surgery; no nail plate dystrophy at the 12-month follow-up (case 15).

36 (53.7%) were 3 mm or wider. No macroscopic Hutchinson sign was identified in any of the cases.

The result of dermoscopy of the LM was available in 62 cases. Dermoscopy revealed a regular gray pattern in 29 cases (46.8%), a regular brown-black pattern in 12 cases (19.3%), and an irregular brown-black pattern in 21 cases (33.9%). In addition, the micro-Hutchinson sign and dots/globules of pigment were found in 9 cases (14.5%) and 4 cases (6.5%), respectively.

The longitudinal-strip nail window technique assisted by a $CO_2$ laser was performed in 67 cases. No patient reported short-term related complications such as thermal damage of nail bed and matrix. The pathologic diagnosis was accessible in all cases, showing melanocytic activation in 39 cases (58.2%), lentigo in 10 cases (14.9%), nail matrix nevus in 17 cases (25.4%), and in situ melanoma in 1 case (1.5%). The patient with melanoma in situ eventually underwent a complete excision of the nail unit with a 6-mm safety margin[14] and second intention healing.

After the surgical procedure, 6 patients with LM caused by benign lesions were lost to follow-up. The duration of follow-up ranged from 7 to 46 months (average, 17.7 months). The patient with melanoma in situ could not be evaluated for recovery of the nail plate because the whole nail apparatus had been removed. In all, 60 patients were thus assessable for the postoperative outcomes. In all, 45 patients (75.0%) had no postoperative nail deformity (Fig 3); 13 had mild onychodystrophy (superficial fissure), whereas 2 developed severe nail deformity, appearing as a nail partial defect complicated with dorsal pterygium. So far, 8 patients (13.3%) have showed recurrence of the pigmented band. Five patients with recurrence of pigmentation underwent a re-excision with the same technique, and the subsequent histopathologic findings all proved to be benign. The remaining 3 patients with recurrence refused to undergo a second operation and a wait-and-see policy was chosen. No visible malignant signs of subungual melanoma have been identified to date.

## DISCUSSION

LM is common and can be challenging for clinicians, especially when making a differential diagnosis. Some LM cases demonstrated relatively uniform clinical and dermoscopic findings, but the final histopathologic results revealed nail melanoma.[15] We believe that the diagnosis of LM cannot be reliably established merely by clinical examination and dermoscopy. Biopsy and histologic assessment remain the criterion standard. Shave surgery can be adopted in most cases of LM to exclude the diagnosis of melanoma. Only in a small portion of LM cases with distinct malignant signs, such as extremely dark color of whole nail unit, obvious Hutchinson sign, ulcer in periungual skin, or rapidly proceeding lesions, which strongly imply nail

melanoma clinically, is excision of the whole lesion down to the bone for a full-thickness biopsy recommended instead of shave surgery.

To expose the pigmented nail matrix, we use a longitudinal-strip nail window technique that removes the whole pigmented part of the nail plate. Compared with traditional partial proximal avulsion of nail plate, our exposure scenario presents the entire nail bed under the pigmented band. The autografted nail matrix melanocytes on the reflected plate are among the significant reasons for the recurrence of pigmentation after shave surgery. In this instance, removal of the whole pigmented band allows surgeon to check and scrape this part of the nail plate thoroughly and reduce the risk of recurrence.

Because the nail matrix is located under the hard nail plate, nail matrix biopsy is more difficult than general skin biopsy. As a result, incision of the LM and exposure of the pigmented nail matrix often require excessive physical force. To overcome this problem, we apply a nail window technique assisted by a $CO_2$ laser before shave surgery. Only several seconds are required to make a partial or complete cut in the nail plate. In addition, we perform only 2 to 3 passes of the laser to avoid thermal damage to the underlying nail bed and nail matrix. After that, the pigmented nail plate can be easily removed with a scalpel. When a $CO_2$ laser is not available, we can also achieve such longitudinal-strip exposure by physically cutting the nail plate with a scalpel.

Shave surgery of the nail matrix (also referred as a tangential matrix excision) was originally described by Haneke.[6] It offers an alternative to punch biopsy, transversely oriented excisional biopsy, and longitudinal excisional biopsy (lateral or median). In this technique, only a superficial piece of matrix tissue is removed, which could allow re-epithelialization of the defect from the surrounding matrix keratinocytes covering the dermis left in place.[8] Compared with other nail matrix surgery that may produce a permanent nail deformity, shave surgery is a minimal scar technique.[7] In our study, 75.0% patients achieved a scar-free nail plate. This confirms that postoperative dystrophy of the procedure is virtually limited. Because the follow-up time in some cases is less than 1 year, these patients are still likely to regrow an intact nail plate over time and the final incidence of nail dystrophy may be even lower.

From a histopathologic point of view, shave surgery yields a specimen of the whole pigmented nail matrix, which contributes immensely to accurate diagnosis. Furthermore, Di Chiacchio et al have confirmed that the thin specimens can provide adequate depth for histopathologic diagnosis if the dermatologist, pathologist, and laboratory technician are well trained and familiar with this technique.[16]

There is some incidence of postoperative recurrence of pigmentation. This probably results from some pigmented matrix melanocytes remaining, activation of neighboring melanocytes caused by surgery, or melanocyte repopulation from the adjacent epidermis. The recurrence rate in our study is about 13.3%, which is significantly lower than in the previous study performed by Richert et al (70.0%).[8] To minimize the risk of recurrence, some modified tips have been applied during the operation: (1) expose all suspicious lesional sites, including the nail matrix and nail bed, completely by reflecting the proximal nailfold and removing the whole longitudinal pigmented band of the nail plate; (2) keep a safety margin of 1 to 2 mm between the incision and lesional tissue; (3) after excision, examine the residual nail matrix, exposed nail bed, and ventral area of the proximal nailfold carefully to avoid any pigmented lesions remaining; and (4) before serving as a biologic dressing, the removed nail plate, especially its ventral surface, should be carefully scraped to prevent potential melanocyte replantation. In addition, using intraoperative matrix dermoscopy to better delineate the lesional margins may also be of some use. Recently, Zaiac et al have injected 0.1 $cm^2$ of 2% lidocaine directly into the area of pigmented matrix.[17] This technique elevates the pigment and makes the matrix thicker, which makes the incision more accurate. It is a preferable option that can be adopted during the shave surgery.

There are still some limitations in our study. Compared with the traditional method of exposure by avulsion of the partial proximal nail plate, our exposure technique may make superficial horizontal shaving procedure technically more difficult to achieve because of the residual nail plate on both sides of the pigmented lesions. In addition, visualization of the entire matrix cannot be accomplished, and subtle pigment in the neighboring area that cannot be seen through plate may be left behind. In a minority of cases, the pathology of the removed nail plate provides important diagnostic information.[18,19] We scrape the nail plate and return it, which may result in the discarding of potential diagnostic tissue (although to date, there is no evidence showing that this will reduce the accuracy of diagnosis). In addition, the follow-up time of some patients is less than 1 year, and they may appear with melanonychia in a later period, which will lead to underestimation of the rate of recurrence to some extent.

So far as we know, our study is the largest case series to evaluate the clinical outcome of shave

surgery combined with nail window technique. It confirms that the postoperative nail dystrophy is virtually limited; meanwhile, the recurrence of pigmentation can also be minimized with the modified surgical techniques. We suggest that the modified shave surgery combined with the nail window technique is a preferable management strategy for patients with LM.

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