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A simulation model of nail bed suture and nail fixation: description and preliminary evaluation

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ABSTRACT

Background: Wounds of the finger nail bed represent a frequent injury, especially in children. Residents often learn nail bed repair on patients without prior training. We aimed to develop and evaluate a "low-fidelity" simulation model of nail bed repair.

Methods: The model consists of a false nail on a plastic finger and a hydrocolloid dressing, which is pasted on the nail bed site and cut horizontally. This model allows nail bed suture and nail fixation. The cost of each model is about $1. Thirty-three doctors evaluated this model on 10 items, rated out of five, concerning the realism, the difficulty of the procedure, and the educational value. The duration of the procedure was also noted. We evaluated the clinical effectiveness by comparing through Fisher's exact test the ratio of unsuitable events (revision surgeries, surgical site infections, and complaint letters) on two periods—3 y before and 18 mo after the implementation of this model in our institution, respectively.

Results: Average mark was 4.16/5. The model was considered reliable, reproducible, and realistic. All the testers recognized a big educational value. The overall duration of the procedure averaged 23 min for residents and 11 min for surgeons. We collected 17 unsuitable events out of 84 patients from the period "before" and 2 out of 54 patients from the period "after" ($P = 0.005$). Revision surgeries were 10/84 from the period before and 2/54 from the period after ($P = 0.04$).

Conclusions: The results of the internal and clinical evaluations are encouraging. We suggest integration of this model into the training program of residents.

Introduction

Nail bed trauma is a frequent pediatric injury (3.5% of domestic accidents).[1] It mostly affects children under 5 y of age with a male predominance.[2,3] The injured fingers are most often the major and annular.[4] The most common mechanism is a crush by a door.

From an anatomical point of view, the nail rests on a very specialized tissue called the "nail bed". The growth of the nail is guided by two lateral skin folds forming rails. The skin around the nail is called the paronychium. The cuticle is the horizontal part of the paronychium. The nail bed is attached to the phalanx. The lesions passing through this zone may be responsible for abnormal nail regrowth[5] (striated, split, or detached).

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When the distal phalanx is crushed, all anatomical structures may be injured: the nail is often dislocated from the paronychium with a hematoma underneath the nail. Wounds of the nail bed are often horizontal; wounds on the lateral or medial part of the pulp and of the paronychium are also common in this context.

The bone of the distal phalanx may be the site of an open fracture.

In case of a patent wound of the nail bed, the nail should be removed under anesthesia (general or locoregional) to allow access to the nail bed for accurate assessment[6] and care. Nail bed suture is usually performed using interrupted stitches of absorbable 5-0 or 6-0 thread. The nail is cleaned, pierced in the center to allow the evacuation of a possible hematoma, inserted below the cuticle to protect the nail bed suture, and then fixed with an X-figure stitch of absorbable or nonabsorbable 4-0 thread.[7]

The lesions are mostly benign, but if the initial management is inadequate, one can have esthetic and functional aftereffects.[8-11]

Nail bed injuries of children are often treated in emergency departments by junior doctors.[1] Often they learn on the patients with (or, sometimes, without) supervision, although simulation stands out as the best mode of learning medical and surgical procedures.[12,13]

To our knowledge, no simulation model of nail bed wounds has been described. Now mandatory in North America, the simulation was recently rediscovered for teaching emergency gestures.[12,13] The most important reason to use the simulation is ethical: *"Never the first time on the patient!"*[14]

Simulation focuses on different fields of knowledge that are complementary to those of traditional education, including both technical and nontechnical skills. The first benefits have been reported in anesthesia and emergency medicine.[15-17] In fact, the simulation increases performance along a learning curve.[18] Simulation during training of health professionals has a positive impact on patient safety. Since the publication of the National Institute of Medicine's *"To err is Human: Building a Safer Health System"*, it appears that risk prevention requires better pedagogy for better care.[19,20]

Our aim is to present an inexpensive model of low-fidelity simulation, which can be used to teach nail bed care to improve its management.

Our hypothesis was that the evaluators find this model reliable and realistic.

We also aimed to assess the clinical effectiveness by comparing the rate of unsuitable events and especially the rate of revision surgery, before and after the implementation of this model in our institution.

Methods

The model is thus constructed:

- Plastic finger with base ("manicure finger", 10 units: about $4 = $0.40/unit; Amazon [Seattle, Washington]) (Fig. 1).
- Hydrocolloid dressing (DuoDERM; ConvaTec, Garenne-Colombes, FRANCE or Comfeel; Coloplast, Oakville, CANADA) (1 pack of 10: about $2 = $0.20/unit).

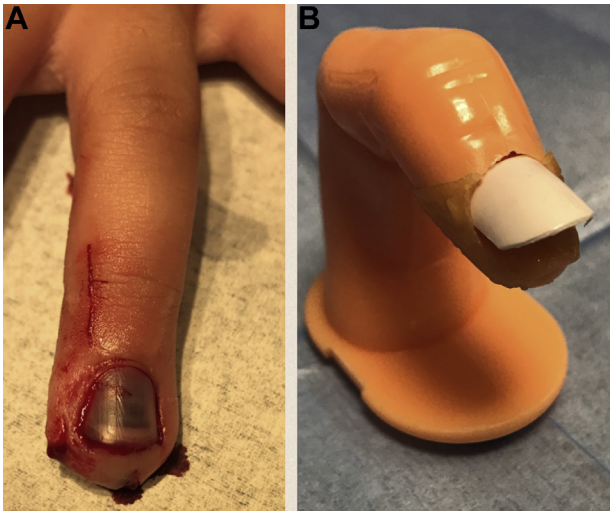

Fig. 1 – General aspect: (A) the real finger with hematoma below the nail; (B) the model. (Color version of figure is available online.)

- False nails (500 units: $3 = $0.006/unit; Amazon).
- Suture set.
- 5-0 monofilament thread.
- 4-0 braided thread.

To assemble the model, a DuoDERM wand is placed horizontally on the plastic finger to cover the nail bed and the entire circumference of the distal phalanx, distally to the cuticle (Fig. 2).

At the beginning of our experience, we noticed that the small thickness of the DuoDERM on the nail bed made it difficult to pass the needle through (Version 1 of the model, V1). A modification was then made, with two layers of DuoDERM on the nail bed, actually doubling the thickness of this zone (Version 2, V2).

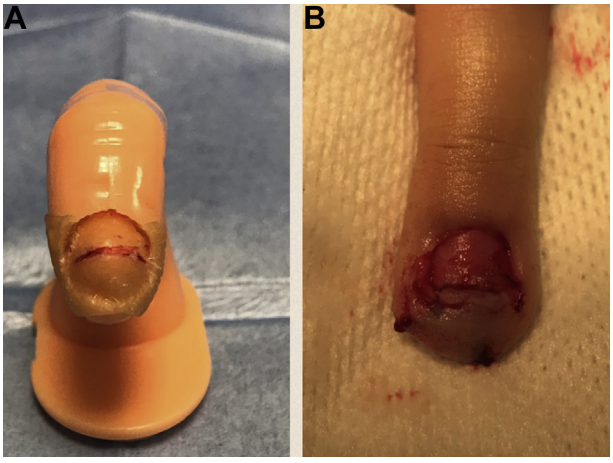

Fig. 2 – Aspect of the nail bed wound after nail removal: (A) the model with hydrocolloid dressing simulating the nail bed and (B) the real wound. (Color version of figure is available online.)