Avulsion Injuries of the Nail Bed Do Not Need Nail Bed Graft

Olayinka Ogunro, MD
Methodist Charlton Medical Center
Dallas, TX

Shade Ogunro, BA
Temple University Medical School
Philadelphia, PA

ABSTRACT

From 1985 to 1992, 12 cases of severe avulsion injuries of the nail bed were treated by allowing the nail bed to regenerate naturally, without a nail bed graft irrespective of the extent of nail bed loss. This involved simply covering the residual nail bed with the nail splint for a period of approximately 6 weeks or until the nail bed was observed to be fully regenerated. The patients were then followed up until full nail growth. It was observed that the nail bed regenerated spontaneously, followed by a normal nail growth identical to the contralateral uninjured nail. Proper coverage of the nail bed protected the culture milieu conducive to natural nail bed regeneration, and nail bed grafting was not necessary irrespective of the extent of tissue loss.

Keywords: avulsion, nail bed injuries, bed, grafting

In 1955, Flatt brought our attention to the fact that when acute nail bed injuries were allowed to heal by secondary intention, poor results were obtained. These injuries were simply treated by dressing with resultant desiccation of the residual nail bed and its culture media. Since then various types of graft have been used in the treatment of these injuries. The most successful to date has been the use of split thickness nail grafts as described by Sheppard. Ogo, however, reported spontaneous regeneration of the nail bed in avulsion injuries that were treated without nail bed graft after amputation at the level of the cuticle. In 3 of the 4 cases presented, the amputated stump was covered with a flap. In the fourth case, a full thickness graft was used to cap the amputated stump. Despite this, avulsion injuries of the nail bed have continued to be treated with nail bed graft, often obtained from an uninjured toe and thus compounding the patient's original injury by inflicting another injury. The authoritative texts in hand surgery continue to advocate this method.

The purpose of this study is to demonstrate that the nail bed has a strong regenerating capacity, and hence, avulsion injuries of the nail bed do not need grafting. In this study, it was noted that when the nail bed was protected with a cover, desiccation was avoided, and the hematoma that formed beneath it became organized into a nail bed with all its natural physiological properties. Based on this observation, we concluded that nail bed grafting is not necessary in acute avulsion injuries of the nail bed as long as a suitable coverage was used to protect the hematoma and the culture media conducive to nail bed regeneration.

MATERIALS AND METHODS

From 1985 to 1992, 12 fingers with acute avulsion injuries of the nail bed were treated in 12 patients (Table 1). These patients were all males with severe industrial trauma to their digits. All injuries presented with the avulsion of the nail bed with an intact germinal matrix except for case 9 (Fig. 1), where at least 50% of the germinal matrix was avulsed. There were 5 associated phalangeal fractures, 3 of which involved loss of the dorsal cortex of the distal phalanx (Fig. 1, case 9, and Fig. 2, case 10). There were 8 cases of pulp avulsions (Table 1), 3 of which necessitated cross finger pedicle flap, and 5 needed a V-Y flap (Fig. 2, case 10, and Fig. 3, case 3).

OPERATIVE TECHNIQUE

The technique consisted of general debridement and repair of the nail bed wherever possible. The segment of the nail bed loss was not grafted. It was simply covered by the nail splint and secured in place by applying proximal sutures of 5-0 nylon through the eponychium to exit in the nail fold, taking care to avoid suturing the
### TABLE 1. Summary of Cases

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Digit</th>
<th>Type of injury</th>
<th>Associated injuries</th>
<th>Date of surgery</th>
<th>Surgery</th>
<th>Associated surgery</th>
<th>Follow-up in months</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19</td>
<td>M</td>
<td>L.I</td>
<td>Avulsion</td>
<td>Pulp loss</td>
<td>3/2/1985</td>
<td>Nail splint</td>
<td>Pedicle flap</td>
<td>8 mo</td>
<td>Full nail regeneration</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>M</td>
<td>L.V</td>
<td>Avulsion</td>
<td>Pulp loss</td>
<td>6/20/1985</td>
<td>Nail splint</td>
<td>Pedicle flap</td>
<td>Lost at 3 mo</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
<td>M</td>
<td>L.III</td>
<td>Avulsion</td>
<td>Pulp loss and distal phalanx fx.</td>
<td>8/9/1985</td>
<td>Nail splint</td>
<td>V-Y Flap</td>
<td>12 mo</td>
<td>Full nail regeneration</td>
</tr>
<tr>
<td>4</td>
<td>23</td>
<td>M</td>
<td>L.I</td>
<td>Avulsion</td>
<td>—</td>
<td>10/31/1988</td>
<td>Nail splint</td>
<td>—</td>
<td>8 mo</td>
<td>Full nail regeneration</td>
</tr>
<tr>
<td>6</td>
<td>41</td>
<td>M</td>
<td>R.III</td>
<td>Avulsion</td>
<td>Distal and middle phalanx fx.</td>
<td>3/10/1989</td>
<td>Repair splint</td>
<td>Bone graft ORIF</td>
<td>6 mo</td>
<td>Full nail regeneration</td>
</tr>
<tr>
<td>7</td>
<td>54</td>
<td>M</td>
<td>R.III</td>
<td>Avulsion</td>
<td>Pulp loss</td>
<td>10/19/1989</td>
<td>Nail splint</td>
<td>V-Y flap</td>
<td>6 y</td>
<td>Full nail regeneration</td>
</tr>
<tr>
<td>11</td>
<td>51</td>
<td>M</td>
<td>L.III</td>
<td>Avulsion</td>
<td>Pulp loss</td>
<td>6/22/1990</td>
<td>Nail splint</td>
<td>V-Y flap</td>
<td>Lost to follow-up</td>
<td>—</td>
</tr>
<tr>
<td>12</td>
<td>33</td>
<td>M</td>
<td>L.III</td>
<td>Avulsion</td>
<td>Fx. Distal phalanx</td>
<td>11/20/1990</td>
<td>Nail splint</td>
<td>ORIF distal phalanx</td>
<td>1 y</td>
<td>Full nail regeneration</td>
</tr>
</tbody>
</table>

ORIF indicates open reduction and internal fixation; fx., fracture.

The suture is then passed through the lateral drainage hole in the splint and then passed retrograde through the fold to exit on the eponychium.

Using the same technique, a second suture is applied through the medial drainage hole. Gentle traction on the suture ends will seat the nail splint in the eponychial fold.

**FIGURE 1.** Case 9. Avulsion of nail bed with 50% loss of the germinal matrix and loss of dorsal cortex of the distal phalanx.

**FIGURE 2.** Case 10. Avulsion of the nail bed with loss of segment of distal phalanx. V-Y flap has been performed.
Distal sutures are then applied as described by Oguno. The splint was trimmed to a length similar to the length of the uninjured nail on the contralateral side, thus restoring some length to the regenerating nail bed (Fig. 4, case 3).

Where V-Y flap or distal flaps were necessary, the flaps were sutured to the distal end of the splint instead of the nail bed (Figs. 2 and 4). This prevented palmar traction on the nail bed and served as a firm support for the flaps and preserved the “dead space,” which became filled with hematoma and organized into the regenerating nail bed. Appropriate dressing was applied for a period of 2 weeks and then followed by the use of a protective Stock splint. The nail splint was removed at approximately 6 weeks or when the nail bed was observed to be fully regenerated as perceived through the transparent splint.

RESULTS

Ten fingers were followed up until full nail bed regeneration and nail growth. Two patients failed to follow up. The follow-up ranged from 6 months to 6 years. After the surgical procedure, a hematoma formed in the “dead space” beneath the nail splint. The excess blood drained through the drainage holes. The hematoma retained its physiological characteristics, and desiccation did not occur. At approximately 1 week, the hematoma became more organized and firm in its consistency and could not be dislodged. At approximately 3 weeks, almost complete ingrowth of nail bed tissue could be observed replacing the hematoma (Fig. 5, case 10).

The regenerated nail bed was grossly similar to the natural nail bed and demonstrated the sensitivity characteristic of the nail bed. By 6 weeks when the splint and sutures were removed, there was no gross difference between the regenerated nail and the residual nail tissue. Histological studies obviously could not be performed. At this time, the nail was noted to have regenerated approximately 4 mm distal to the eponychium, and further nail growth continued until restoration of its full length. This pattern of reconstitution of the hematoma into the nail bed followed by regeneration of the nail was observed in all the digits (Figs. 5 and 6). All the digits demonstrated regeneration of the nail bed and nail, which was equal to or within 2 mm of the original nail length, when compared with the uninjured contralateral side (see Fig. 7). In patients...
FIGURE 7. Case 3. At 6 months’ follow-up, a fully regenerated nail and nail bed without nail bed graft.

FIGURE 9. Case 9. At 9 months’ follow-up, the nail is fully regenerated.

FIGURE 9. Case 10. At 7 months’ follow-up, the nail is fully regenerated.

with a concave or flat nail, the regenerated nail was noted to assume the convexity of the nail splint due to its moulding effect on the regenerating nail bed. There were no infections in any of the case studied.

Although the standard of care for acute avulsion injuries of the nail bed is split thickness nail bed graft, this study demonstrates that the avulsed nail bed has its own inherent regenerative potential. Hence, the intervention with split thickness nail bed graft is not necessary as long as the nail bed is adequately protected. It seems that effective coverage of the nail bed prevents desiccation and protects the clot and its culture milieu conducive to spontaneous regeneration of the nail bed and nail (Figs. 8 and 9). In all the cases, the matrix was not avulsed except for case 9 (Fig. 1), where at least 50% of its substance was avulsed on the ulnar side.