Self-adherent elastic wrap (3M Nexcare; Coban, St Paul, MN; Co-Flex; Andover Healthcare, Salisbury, MA) is an excellent dressing option for hand and finger injuries treated in the emergency department (ED) and primary care settings. Unfortunately, without careful attention to their application, these bandages can cause devastating damage through a tourniquet effect. Pediatric patients are particularly susceptible to this because they often do not have the language or cognitive ability to communicate their pain and are unable to remove the dressing themselves. With the high rate of hand injuries in young children, most of which involve the fingertip, this concern becomes even more prominent.

Tourniquet injuries to fingers have been described to occur by hair, procedural tourniquets accidently left in place, buddy taping, and a variety of bandaging materials. These all share a common mechanism of circumferential wrapping around a digit leading to blockage of arterial inflow and/or venous outflow with subsequent ischemia, tissue necrosis, and potential amputation.

This article describes 5 patients with injuries ranging from skin blistering and discoloration to amputation secondary to tight circumferential application of a self-adherent elastic wrap dressing. It is important that both health care professionals and caretakers of pediatric patients be educated on the potentially disastrous complications of improper dressing application in the pediatric population and can be encouraged to share this information with patients’ families.
recognize this potential complication and learn how to properly apply these dressings.

**METHODS**

After obtaining institutional review board approval, we reviewed the medical records of 5 patients who suffered finger injuries from self-adherent elastic wrap dressings and were subsequently seen by 1 surgeon at 1 academic children’s hospital between the years 2007 and 2015 (Table 1). All records were reviewed for the history of the initial injury and treatment, frequency of dressing changes at home, presence of pain at time of compressive dressing injury, time to evaluation by the pediatric orthopedic hand team, treatment of ischemic injury, and patient outcome. For further follow-up, the patients’ families were contacted to update their progress and obtain current photographs.

**RESULTS AND CASES**

Patient age at time of injury ranged from 11 months to 3 years with 2 girls and 3 boys (Table 1). All cases involved the application of self-adherent elastic wrap dressings. In 4 of the 5 cases, parents performed dressing changes at home. In only 1 case was the dressing causing injury applied by a medical professional. In all cases, the parents were unaware that the wrap could be placed too tightly around the finger and none recalled receiving specific instruction on dressing application. Patients received a formal pediatric orthopedic hand evaluation 2 to 11 days after injury and were managed in-clinic from 15 to 125 days after injury. Only 1 of 5 patients complained of pain or discomfort during the onset of their ischemic injury.

Three patients were treated with local wound care without surgical intervention (Table 1). One patient had a sympathetic block in addition. Patient 1 (Fig 1) was treated with local wound care. At her last clinic follow-up 2 and a half months after injury, she had healed with intact sensation and no contracture. The swelling and erythema noted at 15 days went on to completely resolve, although a transverse nail deformity remained. Patient 2 (Fig 2) was placed into an extension splint and treated with daily dressing changes with bacitracin. She went on to autoamputate a small amount of nonviable tissue distal to the distal interphalangeal joint (DIPJ), but healed with an otherwise normal appearance without dysfunction. In patient 3, an axillary nerve block was performed on initial presentation to the ED in an attempt to decrease sympathetic tone and increase blood flow to the digit. His perfusion improved overnight, and during follow-up the ischemia had resolved with mild blistering that went on to minimal scarring and normal function (Fig 3).

Surgical intervention in the form of an amputation in the operating room was required in 2 cases after waiting for full demarcation of nonviable tissue (Table 1). Patient 4 underwent amputation at the long finger DIPJ (Fig 4), and patient 5 underwent amputation through
the base of the proximal phalanx of the index and long fingers (Fig 5). All surgical wounds healed well and without complication.

We were able to contact all 5 patients’ families for long-term follow-up at a range of 6 months to 8 years after injury (mean 4.1 years). Two of the 5 patients, both amputations (patients 4 and 5), reported currently being bothered by the appearance of the hand. Two patients (patients 2 and 5) reported some hypersensitivity of the injured digits. None of the patients had persistent pain or difficulty using the injured hand.

DISCUSSION AND REVIEW OF THE LITERATURE

Self-adherent elastic wrap is a convenient and effective dressing option for hand and finger injuries and one that we use daily in our institution’s hand surgery practice. Beyond hand surgery, the use of these dressings is ubiquitous, crossing the lines of many clinical practice settings including general pediatrics, urgent care, family practice, emergency care, and postoperative care. However, the same elastic properties that make it desirable for wound management have the potential to cause devastating and long-lasting complications when improperly applied.

To date, examples of injuries secondary to self-adherent elastic wrap dressings have not been addressed in the literature. However, the tourniquet effect and resulting digital ischemia have been described with the use of several other dressing types such as tubular gauze, Band-Aids, and buddy taping. All of these reported cases involved circumferential bandage application around digits inarguably causing proximal occlusion of arterial inflow and/or venous outflow with subsequent tissue ischemia. One factor that may increase the risk of ischemia with digital bandages is the accidental rolling of dressing edges after application, which causes focal compression around digits. This possibility has led some to advocate for extending finger dressings proximally to include the hand. Other variables implicated in causing injury include materials with greater elasticity and applying dressings in multiple layers.

The previously reported cases of dressing-induced ischemic injury have occurred in patients of all ages, with many involving children. Four examples of ischemic injury occurring in individuals aged 10...
and younger were found in the literature.\textsuperscript{9,13,14} In the majority of these cases (3 of 4), the children complained of pain before the injury was discovered. This is in contrast to our findings in which only 1 of 5 patients complained of discomfort. Our observations may be due to pediatric patients being unable to fully communicate the severity of their pain\textsuperscript{1} or may be the result of parents and practitioners having difficulty monitoring and interpreting the signs of pain in children.\textsuperscript{20} In addition, if pain is experienced, children are less likely to be able to remove a painful dressing than an adult,\textsuperscript{2} making children more likely to develop ischemic injury to nerves that further interferes with pain perception. It is also possible that the anatomy and physiology of children’s vasculature makes them more susceptible to compression, with smaller vessel diameter, lower mean arterial pressures,\textsuperscript{21} and higher vessel compliance.\textsuperscript{22,23}

In addition to being a more common injury in pediatric patients, this group often has more severe outcomes compared with their adult counterparts. All cases of dressing-induced ischemic injury in children aged 10 and younger reported in the literature required surgery, and 3 of the 4 resulted in amputation.\textsuperscript{9,13,14} Among our 5 patients, 2 required surgical intervention with amputation. The remaining 3 patients were observed with minimal remaining functional deficit or disfiguration. This is possibly due to the fact that for most of our patients, parents were performing daily dressing changes and caught the ischemia early on.

Our preferred management once digital ischemia from circumferential bandages is identified is to observe the tissues and allow them to demarcate, as long as there are no signs of infection. We feel that this allows maximal tissue recovery. After demarcation,
nonviable tissue is debrided and amputations performed as needed. In cases of acute ischemia, a local or regional sympathetic block can be considered. In 1 of our cases, an axillary block was administered in an attempt to improve blood flow to the affected digit. This patient did not ultimately require surgery, but it is unclear if the block to his sympathetic input improved his outcome. Although not done in our series, the use of leeches has been proposed to alleviate venous congestion, and early surgical intervention has been described with incision and fasciotomy.

To prevent these injuries, elastic and/or circumferential self-adherent dressing should be avoided if simpler dressings suffice and no compression is needed. When simpler dressings do not suffice, our approach to dressing application using self-adherent elastic wrap is as follows:

1. After a sterile dressing is applied, the leading edge of the wrap is placed on the affected area and the end held still while a wrap at least 12 in long is unrolled and allowed to fully relax.

2. Moving from distal to proximal, the wrap is gently laid over the dressing in a controlled manner under minimal tension. This is in contrast to wrapping while simultaneously unrolling, which can lead to excessive tightness.

3. The wrap is overlapped by .25 to .5 in.

4. The overlapping wrap is pressed lightly to allow it to adhere.

5. The process is repeated until the desired area is covered, by using as few overlapping layers as possible.

When dressing fingers, the wrap should be brought down to include the hand to prevent rolling of the proximal edge. In pediatric patients, the placement of a well-padded splint before wrapping should be considered to further help prevent tight constriction. This technique can be taught to caregivers to perform dressing changes at home as needed. Patients and families are also instructed in monitoring for the signs and symptoms of digit ischemia, including observing for increasing pain and checking distal capillary refill and sensation.

Through these 5 cases, we have outlined the complication of dressing-induced digital ischemia in pediatric patients and have described treatment and proper dressing application techniques. When self-adherent elastic wrap dressings are the dressing of choice, all medical professionals using these materials should be aware of this potential complication and make sure patients and families are educated on proper dressing use and instructed on the caveats that would prompt immediate dressing removal.

**ABBREVIATIONS**

DIPJ: distal interphalangeal joint
ED: emergency department
REFERENCES


17. Siegel IM. A clinical reminder. *Orthop Rev.* 1987;16(2):128


Digital Ischemia After Application of Self-Adherent Elastic Wrap Dressing: A Case Series
Christopher A. Makarewich, Penelope Lang and Douglas T. Hutchinson
*Pediatrics* 2018;141;
DOI: 10.1542/peds.2016-3067 originally published online December 7, 2017;

<table>
<thead>
<tr>
<th>Updated Information &amp; Services</th>
<th>including high resolution figures, can be found at: <a href="http://pediatrics.aappublications.org/content/141/1/e20163067">http://pediatrics.aappublications.org/content/141/1/e20163067</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>References</td>
<td>This article cites 23 articles, 2 of which you can access for free at: <a href="http://pediatrics.aappublications.org/content/141/1/e20163067#BIBL">http://pediatrics.aappublications.org/content/141/1/e20163067#BIBL</a></td>
</tr>
<tr>
<td>Subspecialty Collections</td>
<td>This article, along with others on similar topics, appears in the following collection(s):</td>
</tr>
<tr>
<td></td>
<td>Home Safety <a href="http://www.aappublications.org/cgi/collection/home_safety_sub">http://www.aappublications.org/cgi/collection/home_safety_sub</a></td>
</tr>
<tr>
<td></td>
<td>Orthopaedic Medicine <a href="http://www.aappublications.org/cgi/collection/orthopedic_medicine_sub">http://www.aappublications.org/cgi/collection/orthopedic_medicine_sub</a></td>
</tr>
<tr>
<td>Permissions &amp; Licensing</td>
<td>Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: <a href="http://www.aappublications.org/site/misc/Permissions.xhtml">http://www.aappublications.org/site/misc/Permissions.xhtml</a></td>
</tr>
<tr>
<td>Reprints</td>
<td>Information about ordering reprints can be found online: <a href="http://www.aappublications.org/site/misc/reprints.xhtml">http://www.aappublications.org/site/misc/reprints.xhtml</a></td>
</tr>
</tbody>
</table>
Digital Ischemia After Application of Self-Adherent Elastic Wrap Dressing: A Case Series
Christopher A. Makarewich, Penelope Lang and Douglas T. Hutchinson

*Pediatrics* 2018;141;
DOI: 10.1542/peds.2016-3067 originally published online December 7, 2017;

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://pediatrics.aappublications.org/content/141/1/e20163067