

# Laparotomy wound dehiscence: Experience with a tailor-made, skin-stretch device to control evisceration

## KEY WORDS

- ▶ Evisceration
- ▶ Incisional hernia
- ▶ Laparotomy
- ▶ Skin stretch
- ▶ Wound dehiscence

Laparotomy wound dehiscence has high morbidity and mortality rates. Surgeons and wound care nurses use different methods to facilitate wound healing with one of the most common methods being primary closure. The authors present their experience of using tailor-made, skin-stretch devices to manage laparotomy wound dehiscence and control evisceration. The three cases reported in this article were chosen because primary closure was not appropriate. All three achieved successful wound closure within 14–15 weeks of implementation of the tailor-made, short-stretch device without using another alternative closure methods. At 1-year follow-up, all had acceptable scarring and incisional hernia was not identified. It was concluded that the tailor-made, skin-stretch device was a cost-effective, highly versatile, reliable, and non-invasive alternative in the management of laparotomy wound dehiscence and evisceration.

Wound dehiscence is a serious post-operative complication, associated with high morbidity and mortality rates. Once evisceration occurs, the mortality rate ranges from 10% to 40% (Abbott et al, 2007; Johnson, 2009).

Risk factors for wound dehiscence include anaemia, malnutrition, obesity, malignancy, jaundice, steroid use, diabetes, sex, advanced age, wound infection, and increased abdominal pressure – such as coughing, vomiting, abdominal distention, ascites, chronic lung disease, and emergency procedure (Hahler, 2006; Abbott et al, 2007; Johnson, 2009).

Clinicians use a range of methods to manage dehiscenced abdominal wounds. The most common method in the authors' centre is primary closure with or without retention sutures. Wound reclosure with polyglactin mesh (Abbott et al, 2007), negative pressure wound therapy (Kouretas et al, 2009), abdominal binder (Toft et al, 2008; Larson et al, 2009), and various wound closure devices (Harrah, 2001; Barnea et al, 2004; Sandiford et al, 2007) have all been reported to successfully manage wound dehiscence.

## TAILOR-MADE, SKIN-STRETCH DEVICE

The authors' tailor-made, skin-stretch device is made from commercially available medical consumables: stomal appliance faceplate, suction catheter, and a syringe tip cap. The application is simple. First, stomal appliance faceplates are attached to opposite wound edges, then the suction catheter is brought through the faceplate belt ears across the wound edge. The syringe tip cap is pinched onto the suction catheter to maintain the stretching force created (*Figure 1*). Usually, the application of the device takes 5–10 minutes.



Figure 1. Application of tailor-made, skin-stretch device to control evisceration.

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Skin has viscoelastic properties that can be permanently stretched under tension (Barnea et al, 2004) and wound edge approximation can be achieved gradually by shortening the suction catheter over time. The reduced tension of the wound during skin-stretch device application aids wound contraction, which resulted in reduced time to wound closure and acceptable scarring as demonstrated in the following case reports.

## METHODS

The authors conducted a retrospective case series review of three patients with laparotomy wound dehiscence and evisceration whose wounds had been managed with tailor-made, skin-stretch devices between November 2009 and June 2011.

The selection criteria for using the device were deteriorating dehisced laparotomy wounds with evisceration; contaminated or dirty surgical wounds; and wounds for which primary closure was not appropriate.

Exclusion criteria included wounds where delayed primary closure was carried out successfully and non-complicated dehiscence without evisceration had been managed without specialised care.

All three wounds were cleansed daily with saline and packed with moist saline gauze. Thick cotton pads and dry gauzes were used as secondary dressings to cover both the wound and the skin-stretch device. Conservative sharp wound debridement was carried out to remove sloughy tissues as necessary. The devices were applied to wound edges continuously. The length of the device's suction catheter was adjusted on alternate days until wound edges approximated. The greatest wound width was measured when stretching force was released to determine wound progress.

## CASE REPORTS

### Case 1

A 73-year-old woman with a BMI of 30 presented with an ischaemic bowel. A subtotal colectomy and end ileostomy were performed. Wound dehiscence with exposed intestine occurred on postoperative day 17 and large fascial separation was detected along the incision (Figure 2a). The greatest wound width was 8cm. A further operation was not recommended because of the patient's poor general health. The device was applied to control

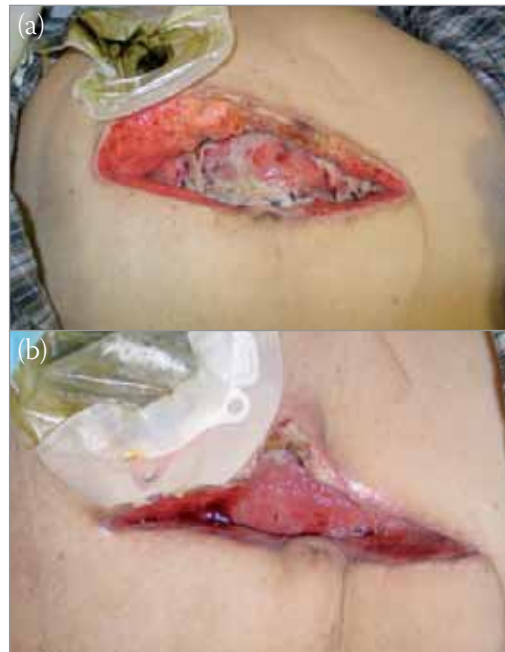
evisceration, with a stoma adjacent to the wound throughout the healing process. The greatest wound width reduced to 6cm after 1 week, and reduced further to 4cm after 3 weeks (Figure 2b). The wound healed after 3 months. No incisional hernia was detected at 1-year follow-up.

### Case 2

A 74-year-old man had a wedge resection of the stomach, which was performed for a gastrointestinal stromal tumour. The operation was complicated by wound dehiscence and evisceration on postoperative day 4 (Figure 3a). A further operation was not suitable for this individual due to a post-operative stroke.

The manual reduction of the bowel loop back to the abdominal cavity through the wound was conducted before the skin-stretch device was applied. The greatest wound width reduced from 6cm to 4cm after 1 week, and then reduced to 3cm after 3 weeks. The wound was fully granulated with significant wound contraction after 10 weeks (Figure 3b). It healed after 3 months (Figure 3c) and no incisional hernia had occurred at 1-year follow-up.

*“The authors conducted a retrospective case series review of three patients with laparotomy wound dehiscence and evisceration whose wounds had been managed with tailor-made, skin-stretch devices.”*



**Figure 2. (a) The patient in Case 1 with wound dehiscence. There is complete fascial separation and exposure of bowel loops. (b) Fully-granulated wound bed after 3-week treatment regimen with the skin-stretch device.**

Figure 3. (a) The patient in case 2 with deteriorating dehisced laparotomy wound and evisceration. (b) Fully granulated wound bed was noted after 10-week skin stretch device application. (c) The patient had acceptable scarring and no incisional hernia.



**Case 3**

A 71-year-old woman had received emergency Hartmann’s operation for ruptured sigmoid diverticulitis and faecal peritonitis. Wound dehiscence occurred 9 days postoperatively and gradually led to evisceration. Fascial separation was found along the whole incision (*Figure 4a*).

The greatest wound width was 3.5 cm, which reduced to 3 cm and 1.5 cm after 1 week and 3 weeks, respectively. The patient also experienced a reduction in pain. Mobilisation was possible after the skin-stretch device had been applied.

The wound healed completely after 4 months. No incisional hernia was detected at 1 year follow-up.

**RESULTS**

Three patients with an average age of 72.1 years had dehisced, contaminated, or dirty surgical wounds and evisceration. None were suitable candidates for further operations and all required the skin-stretch device to control wound dehiscence.

The greatest reduction in wound width after the first week of use of the device was 33%, and average reduction was 24.1%. After 3 weeks of using the skin-stretch device, the greatest wound reduction from baseline was 57%, with an average reduction of 52.4%. All three individuals required 14–15 weeks to achieve complete wound healing (*Table 1*).

All three patients achieved wound closure and no major wound complications were noted. None of the patients required further operations or procedures for wound closure. The cosmetic



Figure 4. (a) The stomal faceplate can accommodate adjacent stoma. (b) The stomal pouch could attach to the faceplate before creating stretching force.

outcome was good; all three individuals had acceptable scarring.

**DISCUSSION**

Various methods are available for wound closure, such as skin grafts and skin flaps, but few are commonly used for closing laparotomy wounds (Harrah, 2001; Sandiford et al, 2007). Dehiscence of laparotomy wounds is commonly addressed by the application of retention sutures (Abbott et al, 2007). However, this procedure must be carried out under general anaesthetic and is therefore inappropriate for those patients not well enough to undergo a second surgery.

Commercial skin-stretch devices – such as Demaclose® RC (Wound Care Technologies), Silver Bullet Wound Closure Device (Boehringer Laboratories), Wisebands wound closure device (4Med), and skin adhesive strips (3M; Smith & Nephew) – are available.

Demaclose® RC consists of several skin anchors which penetrate the skin into subcutaneous tissue and require staples to fix them in place. Similarly the application of Silver Bullet Wound Closure Device requires suturing to wound edge tissue and gradually tightens to strengthen the stretching force. The Wisebands device consists of a flat plastic band that is punctured through the wound edges and reaches down under the skin defect. The device produces 3-dimensional adjustable stretching force, which allows more durable wound closure.

Table 1. Summary of the greatest wound widths and total healing times in three patients treated with the tailor-made, skin-stretch device

	Week			Total healing time (weeks)
	0	1	3	
<b>Case 1</b>				
Actual size (cm)	8	6	4	15
Reduction (%)		-25	-50	
<b>Case 2</b>				
Actual size (cm)	6	4	3	14
Reduction (%)		-33	-50	
<b>Case 3</b>				
Actual size (cm)	3.5	3	1.5	14
Reduction (%)		-14	-57	
Average reduction (%)		-24.1	-52.4	14.3

Other than skin adhesive strips, the application of commercial skin-stretch devices is an invasive procedure and is traumatic to patients, and must be carried out in the operating theatre. It is not feasible for individuals with poor morbidity or who are physically unfit to receive further surgery under general anaesthesia. The creation of new wounds during application of the commercial products could be a source of wound infection. The authors' tailor-made skin-stretch device was applied at the bedside during wound dressing without trauma to the patient. Moreover, the presence of stoma adjacent to the laparotomy wound, such as that outlined in Case 3, would probably interfere with the application of commercial skin-stretch devices.

The tailor-made, skin-stretch device described here promoted wound healing and pain reduction in the three cases reported. The stretching force maintained by the device allowed the wounds to contract significantly, within a short time period. The device controlled evisceration and reduced pain. The device was also cost-effective, in view of the low cost of the medical consumables.

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One of the main advantages of the skin-stretch device was its versatility and flexibility, which makes it suitable for different wound sizes and conditions. The length of the suction catheter is inversely proportional to the stretching force so that it was possible to make adjustments by shortening the suction catheter. The suction catheters could easily be removed as necessary for wound inspection and wound cleansing. The adjustable stretching force ensured the application was appropriate and safe enough to allow enhanced wound healing without causing injury. The controlled wound edge approximation enhanced cosmetic outcomes and scarring was acceptable (*Figure 3c*). Unlike other similar products, even the presence of adjacent stoma would not hinder the application of the skin-

stretch device. A simple modification can be made to accommodate both the stoma and the wound as shown in Case 3 (*Figure 4*). Since the tailor-made, skin-stretch device originated from the stomal appliance, a stomal pouch could be attached (*Figure 4b*) to contain effluent from stoma without contaminating the wound.

The stomal appliance faceplate is made of durable materials. In the authors' experience, the device can be kept in place for up to 2 weeks and reliable stretching force can be maintained over this period. The early mobilisation of patients was possible while wearing the device, which favoured recovery of patients.

The noninvasive and nontraumatic properties of the skin-stretch device allowed straightforward application without causing further pain. The stomal appliance faceplate serves as skin attachment and protection. The relatively large area of skin attachment – compared with skin adhesive strips – may prevent increased shearing forces acting on the epidermal–dermal junction, which can result in blister formation and further skin breakdown. No complications were reported in relation to the device during and after wearing.

## CONCLUSION

The tailor-made, skin-stretch device was cost-effective, achieving wound contraction and healing using common medical consumables. The device allowed controlled wound edge approximation, wound healing, and acceptable cosmetic outcome. Its versatility and flexibility made it possible to adjust stretching force and accommodate different wound conditions, including presence of adjacent stoma. The device proved to be easy-to-use, reliable, and noninvasive, which encouraged patient mobility. No complications were associated with the application of the device.

***“The tailor-made, skin-stretch device was cost-effective, achieving wound contraction and healing using common medical consumables.”***

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