

# Trial of an Available Technology Dressing for Resource Limited Settings

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## SUMMARY

Our quest to provide an evidence-based solution for wound management in remote and conflict areas of tropical developing countries led to published literature reviews on the topic in 2013.<sup>1-3</sup> More searches of the formal and informal research literature followed. Improvised dressings used in India, Ghana, Uganda, Japan, Australia, and the USA on burns, surgical wounds, leg ulcers, and pressure injuries provided context.<sup>3-10</sup> The Wound Healing Foundation provided a small research grant. Finally, in 2021 a significant modification of a dressing technique proven successful for Japanese pressure injury patients whose public assistance benefits are depleted was trialed in a controlled tropical setting (Kingston, Jamaica) on sickle cell leg ulcers.<sup>10,11</sup> The resultant evidence-based Available Technology Dressing (ATD) technique uses only materials which are affordable and easily available in virtually every corner of the globe.<sup>3,11</sup>

## PROBLEM

Clinicians in settings ranging from remote villages to inner cities need a safe, effective, affordable, culturally acceptable, available, easy-to-use evidence-based dressing solution to teach wound patients with minimal resources who are being dismissed from their care.

### Focus on Sickle Cell Leg Ulcers

Sickle Cell Leg Ulcers (SCLUs) are among the most challenging of wound types to manage. Standard of care for SCLUs world-wide is wet-to-dry gauze or dry gauze over an ointment, because more costly dressings have not led to superior outcomes.<sup>12,13</sup> The lifetime prevalence for sickle cell leg ulcers is 7.5-70%, with the highest being in Jamaica.<sup>12-16</sup> The etiology is complex, while the physical and social burdens are high.<sup>14-17</sup> Teens often drop out of school due to SCLUs.<sup>14,15</sup> Unlike venous insufficiency ulcers, SCLUs are also ischemic,<sup>12,13</sup> which helps explain why, in addition to being difficult to heal and recurrent, they are so painful that opioids are often prescribed.<sup>12</sup> The average duration of the study SCLU was 7.7 years for the WTD group, 7.0 years for the PMD group, and 8.4 years for the ATD group.<sup>11</sup> Some participants had sickle cell-related physical and/or cognitive limitations which made completing the forms correctly challenging.<sup>11</sup> Despite living in a culture of close-knit families, family assisted only 6 of our 40 study participants with wound care.<sup>11</sup>

## METHODS

This three-armed 12-week evaluator-blinded randomized controlled trial (n=40) compared:

- A negative control (wet-to-moist dressings, or WTM), which is superior to usual practice because it promotes moist healing<sup>1</sup> and is far less traumatic to remove (n=16)
- ATDs: cut-to-fit perforated (with slits) food-grade plastic sealed at the periwound by a moisture barrier, with an absorbent over the perforations, held in place with a wrap (n=13)
- A positive control (polymeric membrane dressings, or PMDs, the advanced dressings with the strongest evidence to support their use in a tropical setting)<sup>17</sup> (n=11)

Dressing changes were conducted by the patients themselves, most of whom had minimal education. Data, including persistent and dressing change pain, time and supplies used, Wound Quality of Life, and The Adult Sickle Cell Quality of Life Measurement Information System (ASCQ-Me®) scores, were submitted via WhatsApp weekly, with in-person clinic visits after weeks 1, 4, 8, and 12 unless the ulcer closed or complications arose. Initial and final wound tracings were measured electronically to determine the change in area.

## OUTCOMES/RESULTS

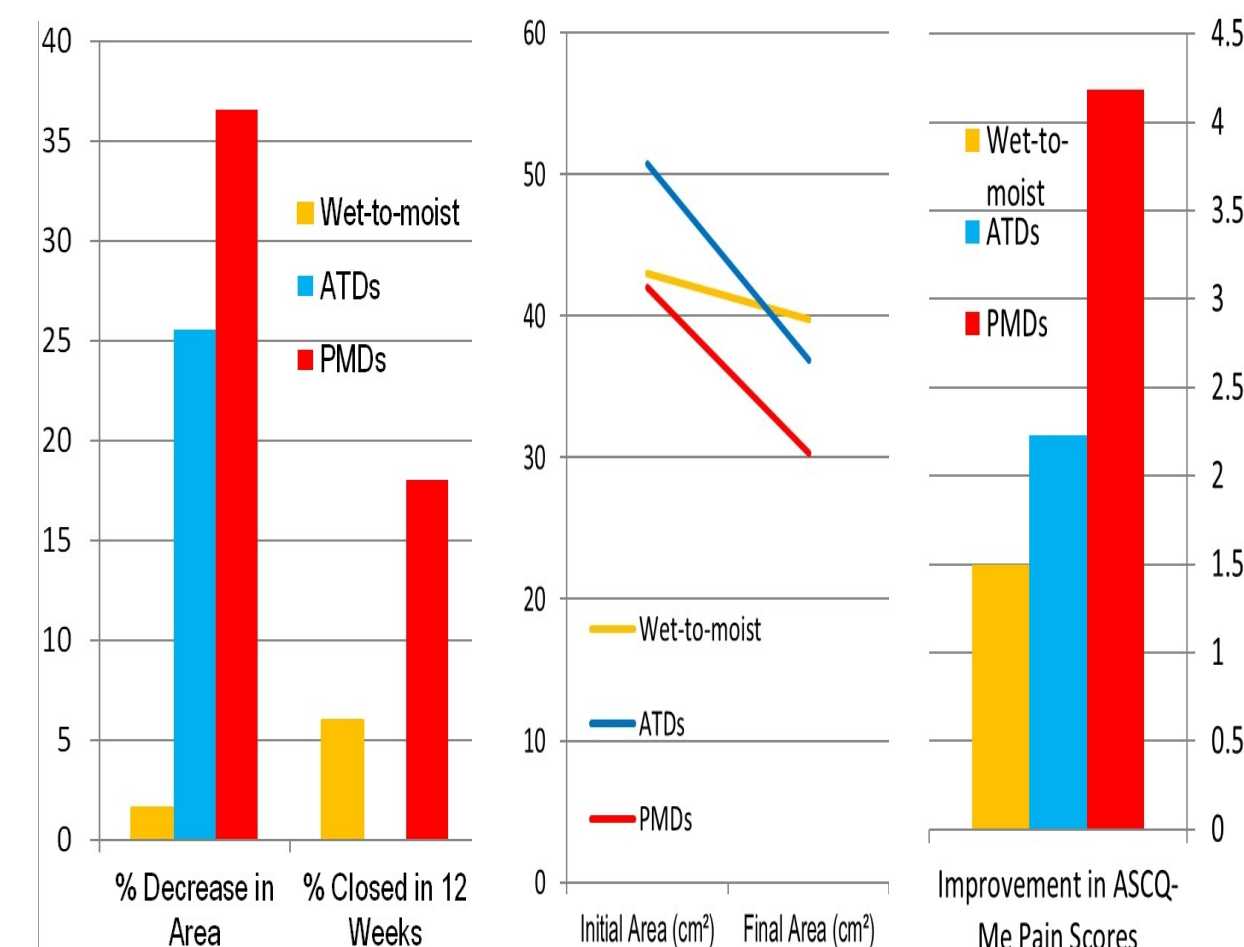
All three study groups had improved mean healing and quality of life scores when compared with their mean initial values. ATD participants' mean final pain and quality of life scores were superior to those of the study participants using WTM. Complications were limited to superficial pseudomonas infections, successfully treated with dilute vinegar. Wound infections were in participants in the WTM group (25% vs 0% in the other two groups). Statistical significance was not reached with this small, highly heterogeneous, sample. The clinical significance of the results were dramatic. Wounds managed with ATDs were four times more likely to decrease in size than those managed with WTM (OR4.06, 80%CI = 1.12 to 16.73), and only one third less likely to decrease in size than those managed with the "Gold Standard" PMDs (OR1.33, 80%CI = 0.242 to 8.37. ATDs were far less expensive than PMDs, although their use was more time-consuming. The participants found ATDs highly acceptable.

### Available Technology Dressing Materials List

1. Irrigation: Use a hot wire (or a bicycle spoke) to poke a hole in the lid of a plastic soda bottle. Fill with clean water. Add a cap full of salt, if desired. Shake well.
2. Moisture protection for the surrounding skin: a thick ointment or cream such as is used on babies' bottoms, available in pharmacy depts. It should not sting.
3. Thin clear food-grade plastic baggie or wrap and a scissors or blade to cut it a little bigger than the wound. Cut a slit in it where fluid would pool when standing.
4. Absorbent material used to absorb menstrual flow, or fluffed gauze or cotton strips (can wash and reuse).
5. Wrap: Elastic or crepe bandage, sock, long sleeve from a child's T-shirt, or strips torn from an old cotton sheet (wash).

### Dressing Wounds Using the ATD Technique

1. Irrigate well (squeeze hard on the bottle!)
2. Dry the skin around the wound (but not the wound). Apply a thick rim of moisture protection around the wound edges.
3. Place the cut plastic over the still-moist wound, gently pushing any air out of the slit(s). The edges should meet.
4. Fluff absorbent material and place it over the slits to absorb the wound fluid that "burps" out of the slit(s).
5. Secure all dressing materials well with the "wrap."



## CONCLUSION

The ATDs proved to be a safe, effective, affordable, and acceptable solution for chronic SCLUs in Jamaica, and their use improved quality of life. Study participants were able to master the dressing technique quickly, and preferred these dressings over other choices.

## IMPLICATIONS FOR CLINICAL PRACTICE

Considering these study results and the wide range of settings, patient comorbidities, and wound types<sup>3-6,9-11</sup> in which similar improvised dressing techniques have proven successful, it is reasonable to expect that ATDs can safely promote wound healing for diverse wound types in remote and low resource settings. Although dressing changes took significantly longer with ATDs, patients found them acceptable, and they were extremely cost effective.<sup>11</sup> This study provides increased confidence that teaching the ATD technique to patients with limited access to health care professionals is unlikely to cause harm, and is likely to result in better outcomes than gauze alone, which proved inferior in this study. Due to their limited availability and high cost, access to advanced dressings can be a barrier for this patient population, and if they are obtained at all, they may be left in place too long.<sup>3</sup>

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## AVAILABLE TECHNOLOGY DRESSING PROCEDURE AND PATIENT EXAMPLES



Daily, the wound was (1) irrigated with homemade saline from a plastic bottle with a hole in the cap. (2) A new clear plastic bag was cut slightly larger than the open wound area, with slits for excess exudate to escape. The periwound was dried and (3) protected with a moisture barrier (zinc oxide paste), which also sealed the edges of the plastic. Gently conforming the clean inner surface of the clear plastic to the wound contours eliminated dead space. (4) A clean absorbent (fluffed gauze) contained the exudate emanating from the slits. (5) A wrap held the dressing in place (stretch gauze). Every component needed for ATDs is affordable and available in both remote villages and inner city discount stores.

### Case Example 1:

A 61 year old man whose left leg was amputated 19 years previously due to osteomyelitis at a sickle cell leg ulcer site developed an ulcer on his right leg two years prior to enrolling in this study. He managed the ulcer with prescription creams. The ulcer gradually increased in size. The dressings adhered to the wound bed, making dressing changes painful and time-consuming. He lives alone, working as a carpenter. The initial ulcer was 9mm deep and 15.2cm<sup>2</sup> in area.

The man was randomized into Group 2: Available Technology Dressing. Because he did not have a camera-phone and could not read well, he agreed to come to the study site every week for wound photos. An NP called him between visits to collect his daily data. After a week of autolytic debridement and decreased edema, the ulcer measured 18cm<sup>2</sup>. The ulcer then remained clean and closed steadily.

The participant found dressing changes to be quick and easy. Pain at dressing changes was not greater than his persistent pain, and both were zero for the final weeks of the study. The ulcer depth decreased dramatically and the area decreased to 12.2cm<sup>2</sup>. At last contact, he was still using the ATDs, which were keeping his ulcer clean and supporting granulation.



### Case Example 2:

A 34 year old woman suffered with recurrent bilateral partially circumferential excruciatingly painful sickle cell leg ulcers for over 20 years. She had the study ulcer for 4.5 years prior to enrollment. Local rural hospital nurses cleaned and dressed the ulcers with ointment and wet gauze three times a week, a process which took hours and resulted in so much bleeding due to the dressings adhering that she often required transfusions. The initial size of the study ulcer was 3mm deep with an area of 163cm<sup>2</sup>.

The woman was randomized into Group 1: wet-to-moist dressing. Dressing changes remained painful. Although the dressings did not adhere as badly, she still lost so much blood at dressing changes that she required transfusions twice during the 12 week study. The ulcer became slightly cleaner, but the area increased slightly in size (167.9cm<sup>2</sup>) and her persistent pain remained 8 - 10.

The woman chose to try the PMDs at the conclusion of the study. She was astonished to find that these dressings felt as if she "did not even have a wound at all." Her wound stayed clean with no rinsing at dressing changes, but she quickly used up all of the remaining PMDs. Switching to the ATDs led to only slightly more persistent pain (2 - 3) than with the PMDs, no dressing change related pain, and continued wound closure. One year later, she is even more pleased with the ATDs. Closure continues, there is no bleeding, and she states, "I don't feel as if I have ulcers any more. I am eating and sleeping much better now." She has a life again.



## To use ATDs effectively, participants had to learn to:

- Take the time to change their ATD every day
- Avoid scrubbing the wound bed, trusting in autolytic debridement
- Squeeze the irrigation bottle hard, obliquely to the wound bed
- Dry only the periwound, leaving the wound bed moist
- Apply the skin protectant right to the edge of the SCLU
- Learn to cut short slits, not holes, in the plastic
- Position the slits so that all the excess wound fluid would drain out
- Fluff the absorbent so that it would absorb that excess fluid better
- Choose a convenient wrap to hold the ATD on; apply it carefully
- Locate an inexpensive skin protectant (many asked a pharmacist)

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