

# A New Method\* for Applying Constant Tension Approximation (CTA) to a Large Wound Deficit

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## INTRODUCTION

The closure of large wound deficits is a great challenge to clinicians. Employment of constant tension approximation (CTA) to take advantage of the viscoelastic properties of soft tissue has been successful with invasively implanted pins<sup>1-3</sup>. The application of constant tension traction to wound margins acts by both approximating the wound and stimulating tissue and skin generation. Researchers report that CTA acts by stimulating angiogenesis and epithelial proliferation<sup>4</sup>. In addition, they note that the means of applying the force to the skin is an important aspect.

Various factors have a bearing on the amount of stretch that can be safely exerted on the skin. These are age, sex, state of health, skin site, skin thickness, and duration of the stretching force. Clinical indications for constant tension approximation include acute wounds, debrided wounds, and chronic ulcers. Using stretching devices in an ischemic area or in the presence of acute inflammation is contraindicated.

Wound approximating systems have been developed and used successfully in closing wounds that otherwise require a skin graft or flap closure. However, the use of these devices adds substantial cost to the plan of care and may also impact on a patient's quality of life.

## CLINICAL HISTORY

A 52-year-old female with a 30-year history of rheumatoid arthritis and steroid use resides with her husband and a teenage daughter who attends high school. The patient developed avascular necrosis of the L femoral head and underwent a total L hip arthroplasty. Post-operatively she developed a Methicillin-resistant *Staphylococcus aureus* (MRSA) infection with wound dehiscence. The patient was treated with IV antibiotics and the wound was left open to heal by secondary intention. Subsequently, the orthopedic hardware was also deemed infected. The prosthesis was removed and replaced; however it, too, became infected and was subsequently removed.

A cadaveric bone with cerclage wires was implanted and anchored to existing bone. Antibiotic beads and IV antibiotics were administered. The wound deficit, measuring 18.5 x 5 cm, was left open. During this period the patient was confined to home and instructed not to bear weight.

Subsequently, she obtained a plastic surgery consultation hoping for wound closure. Treatment using vacuum assisted closure was initiated and the patient was referred to three specialty centers for closure evaluation. Each offered the same three options: 1) disarticulation at the hip with probable long-term hospitalization, ventilation and a greater than 80% mortality; 2) attempted muscle grafting with greater than 95% chance of eventual disarticulation of the hip within the same hospitalization, carrying a 95% chance of mortality; 3) continuation with vacuum assisted closure with some decrease in wound size

## CLINICAL HISTORY CONTINUED...

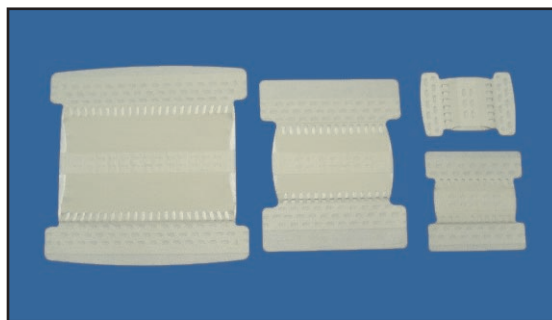
expected, complete closure not probable, the risk of sepsis always present with probable morbidity and eventual 100% mortality. After much angst, the patient chose the latter option. She felt that she wanted to "take my chances and be as much of a mother as I can to my daughter."

After a total of nine months using vacuum assisted closure, the wound measured 7.5 X 2.5 cm. During this time, the patient was able to perform partial weight bearing and wheelchair transfers. Although she was physically able to attend social events and participate in her daughter's activities, eligibility for home care services required her to be homebound. She expressed sadness at missing her daughter's high school sporting events, parent-teacher conferences, and "trips to the mall."

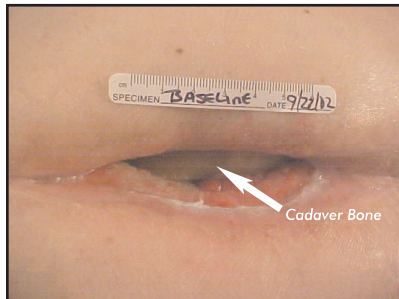
While treatment continued, there was no further reduction in wound size after six additional weeks using vacuum assisted therapy. The patient continued to express dismay at the homebound requirement. Adding to the stress experienced by this family, her husband lost his job so it was economically impossible to meet the co-payment requirements for durable medical equipment (vacuum assisted closure).

## CONSTANT TENSION APPROXIMATION: PRODUCT DESIGN

Clinicians supervising the wound treatment protocol became aware of a new dressing that could provide constant tension to approximate wound margins.\* The unique design of this product incorporates a composite dressing pad of absorbent material bonded to adhesive layers. The pad is surrounded by a pliable material into which holes are cut to allow the adhesive layers to lock and bond to the pad. A flexible synthetic allows the absorbent pad to remain in contact with the wound and absorb exudate while allowing body movement. The clinicians developed a treatment regimen that included applying this dressing to the wound margins to achieve constant tension approximation.



## RESULTS and DISCUSSION



**Figure 1.** Cadaver bone visible in wound. Wound size 7.5 cm x 2.5 cm, 9 months after vacuum assist closure.



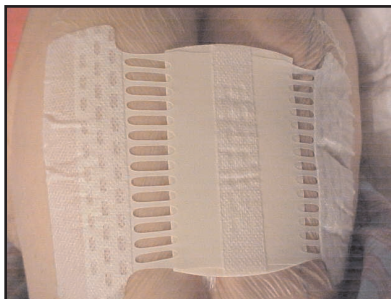
**Figure 2.** Dead space packed with topical silver antimicrobial dressing.



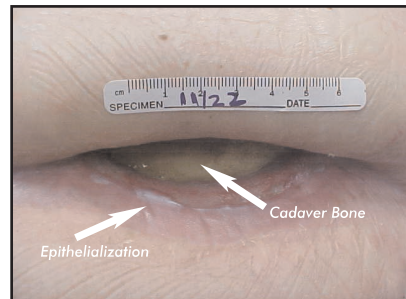
**Figure 3.** Transparent film dressing in place on periwound area.



**Figure 4.** Application of edge of constant tension approximation dressing to periwound area.



**Figure 5.** Constant tension approximation dressing in place.



**Figure 6.** Wound size 6.0 cm x 2.0 cm after 6 weeks of constant tension approximation. Epithelialization present at wound margins. Periwound skin intact. Overall wound size decrease of 36%.

## RESULTS and DISCUSSION

The wound deficit measured 6.0 x 2.0 cm within six weeks after initiation of constant tension approximation using the new dressing, a 36% decrease in size. Epithelialization was present at the wound margins and the periwound skin remained intact.

Because this was the first time the dressing had been used for this clinical indication, learning how to achieve the desired tension occurred through trial and error. Clinicians soon learned that the dressing tension is proportional to how much it is stretched, as well as to the size of the wound deficit. A laboratory study conducted during this clinical trial concluded that the dressing tension is proportional to how much the dressing is stretched when applied, and the circumference of the limb or size of the abdomen.<sup>5</sup>

One of the main goals for this patient's treatment plan was to improve quality of life. The clinician felt challenged to identify a cost-effective treatment regimen that would protect the site, reduce risk of complications, and allow the patient to resume some normal activities. During use of the constant tension approximation dressing, the patient denied pain and adverse effects. In fact, she expressed great pleasure at being mobile, not attached to a device, and able to participate in her daughter's activities. She is able to bear full weight and began walking short distances and states, "I haven't been this happy in years!" Home health services continue monthly and her husband performs dressing changes with nursing supervision.

Researchers have noted that healthcare providers need to be aware of the potential impact of a chronic wound on the patient, the caregiver, and the family and that assessment of how they adapt to the wound is an important component of the care plan.<sup>6</sup> In this case, the clinicians identified quality of life issues as having an impact on wound care and evaluated the family's ability to cope with stressful events. These factors played a key role in the development of a unique and cost-effective care plan.

The cost of the large size (7" x 7") constant tension approximation dressing used on this patient is approximately \$5.75 and frequency of change was once per week. Additional treatment costs included the packing material which was changed weekly or as needed for exudate management, while the tension dressing and transparent film remained in place. For vacuum assisted closure, the 2003 Medicare coverage policy allows up to 10 canister sets per month @ \$24.53 each and 15 dressing kits per month @ \$27.42 each, in addition to the rental charge for the electrical pump (\$1,716.46).

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## TREATMENT PLAN

### Objectives –

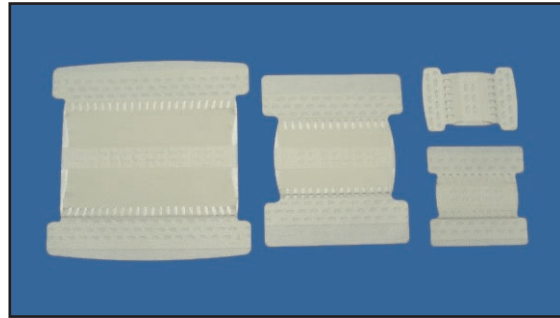
- Achieve additional closure of wound
- Improve quality of life
- Simplify topical treatment so a family member could change dressings
- Identify a cost-effective alternative to vacuum assisted closure

### Frequency of change –

- Topical silver antimicrobial dressing changed weekly or as needed for exudate management
- Constant tension approximation dressing and transparent film changed weekly

### Dressing procedure –

- Irrigate wound
- Pack dead space with topical silver antimicrobial dressing
- Prepare periwound skin with barrier wipe
- Cover periwound area with transparent film dressing (long term steroid use put patient at risk for compromised skin integrity)
- Apply one edge of constant tension approximation dressing to periwound area
- Manually approximate wound edges
- Stretch constant tension approximation dressing across wound and apply opposite edge of dressing to skin
- Observe wound weekly and record measurements



## CONCLUSION

A new, untested approach to constant tension approximation was selected as a treatment of last resort for this patient who made an informed choice against surgery which she felt would be too demanding and severely impact quality of life. She fully understand that although this method could assist with wound closure, the wound will remain open, possibly become infected, and that sepsis is a likely event. The patient experienced a dramatic improvement in quality of life while using the constant tension approximation dressing.

This uniquely designed new wound dressing can function as an external constant tension approximation device, intended to close wounds by using the viscoelastic properties of the skin.

Clinical indications for constant tension approximation include acute wounds, debrided wounds, and chronic ulcers. This dressing is simple to use, inexpensive, and should be considered as an alternative for patients with hard-to-heal wounds. For this patient, it was a cost-effective alternative to support wound closure and improve quality of life.

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## REFERENCES

1. Hirshowitz, B, Lindenbaum, E, Har-Shai, Y. A skin-stretching device for the harnessing of the viscoelastic properties of skin. *Plast Reconstr Surg* 1993;92:260-70
2. Ger, R. The use of external tissue expansion in the management of wounds and ulcers. *Ann Plast Surg* 1997;4:352-7
3. Ersek, RA, Vazquez-Salisbury A. Wound closure using a skin stretching device. *Contemp Orthop* 1994;6:495-500
4. Ger, R. Wound management by constant tension approximation. *Ostomy Wound Manage* 1996:40-6
5. Pittman, J. The chronic wound and the family. *Ostomy Wound Manage* 2003:38-46