
Continuous External Tissue Expansion

-A Novel Intervention for Closing Fasciotomy Wounds-

E Rode, PA-C; K Reggin, RN; B Carlsen, MD - Department of Plastic & Reconstructive Surgery
Mayo Clinic, Rochester, MN



Presented at Wound Healing Society - Spring 2010

CASE 1

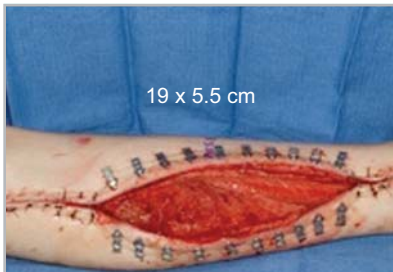
A healthy 17-year-old male high school student suffered a cardiac arrest. Due to ischemia reperfusion injury, he developed bilateral lower extremity compartment syndrome of all four compartments with muscle necrosis. He underwent serial debridement of necrotic tissue before closure could be performed. This was accomplished after eight weeks of aggressive wound care.



Bilateral Lower Extremity Four Compartment Fasciotomy Wounds

Application of Continuous External Tissue Expander (CETE) Anchors.

Distal and proximal aspect of medial leg approximated and closed by delayed primary intention. CETE anchors were placed approximately 2 cm apart and secured to the skin with staples.



Day 1 - Left Medial Leg



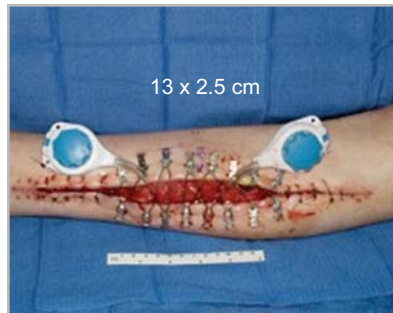
Day 1 - Right Medial Leg

Initial Application.

Photos below were taken immediately following application of the CETE device. Greater than fifty percent reduction in the wound area was achieved.



Day 1 - Left Medial Leg



Day 1 - Right Medial Leg



Day 6 - Left Medial Leg



Day 6 - Right Medial Leg

Delayed primary closure.

Bilateral medial leg wounds were closed primarily resulting in minimal amount of scarring due to closure at the original incision line.



Left Medial Leg



Right Medial Leg



Bilateral Medial Leg Wounds

CASE 2

44-year-old male laborer underwent a cervical laminectomy, foraminotomy, fusion and iliac crest bone grafting. His operation was complicated by bilateral extensor compartment syndrome and required urgent fasciotomy for release of bilateral extensor compartments including the mobile wad. The flexor compartments were spared because of an accurate clinical exam and by direct measurement of compartment pressures.



Day 1 - Left and Right Dorsal Forearm

Combining Therapies.

The CETE device was used in conjunction with NPWT to achieve optimal wound closure while also maintaining a dry environment by pulling excess exudate from the wound.



Day 1 - Left Dorsal Forearm



Day 1 - Right Dorsal Forearm

CETE and Negative Pressure Wound Therapy (NPWT).

The DermaClose is able to expand tissue and work in conjunction with the NPWT with neither systems' function being interrupted.



Day 1 - Left Dorsal Forearm



Day 1 - Right Dorsal Forearm



Day 4 - Left Dorsal Forearm



Day 7 - Right Dorsal Forearm

Closure of Bilateral Forearm Wounds.

Left forearm. On day four, the CETE device and NPWT were removed. The left arm was closed by delayed primary intention with minimal tension.

Right forearm. On day seven, the CETE device and NPWT were removed. The majority of the right arm was closed by delayed-primary closure. A small, central area required a split thickness skin graft to achieve full soft tissue coverage.

Follow Up Three Months after Closure.

The Left Forearm Wound completely healed. A narrow, linear scar offers an excellent cosmetic outcome.

The Right forearm healed without complications on the original incision line distal and proximally. A wound remains as result of incomplete take of the split-thickness skin grafting complications.



Left Dorsal Forearm



Right Dorsal Forearm

BACKGROUND

The purpose of this case series is to report the effectiveness of continuous external tissue expansion (CETE) as a method of fasciotomy wound closure. Primary closure of fasciotomy wounds can be difficult due to edema and tissue retraction. Common methods of closure include split-thickness skin grafts (STSG), use of vessel loop techniques (Jacob's ladder), sequential static tensioning, negative pressure wound therapy (NPWT) and secondary intention. All of these techniques have certain limitations, complications and risk factors.

METHOD

Four fasciotomy wounds in two patients could not be closed by primary intention (2 forearm and 2 medial calf fasciotomy wounds were treated with a new device; DermaClose® RC (Wound Care Technologies, Inc. Chanhassen, MN). Once applied, the device maintains a constant calibrated dynamic tension. The goal of the study was to reduce the size of the defect for subsequent STSG. The medial calf wounds (Case #1) measured 19cm x 5.5cm (left) and 16cm x 5cm (right) on the day of application and reduced approximately 50% post-application. On day 6 the margins had fully approximated and the wounds were closed primarily without complication. The forearm wounds (Case #2) measured 17cm x 7cm (left) and 17cm x 12cm (right). NPWT was utilized in conjunction with the CETE less than 24 hours after the fasciotomy incision to manage exudate. On day 4 the left forearm was closed primarily. A small STSG was needed for closure of the right forearm wound on day 7.

CONCLUSION

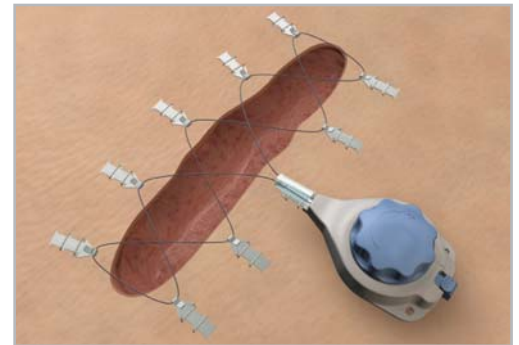
The CETE device was effective in facilitating closure after emergent compartment releases in all four wounds. In 3 of the 4 fasciotomy wounds, delayed-primary closure was achieved. The remaining fasciotomy wound was treated with a STSG and was significantly smaller than would have been without use of the CETE device. Our results suggest that CETE is a useful alternative to other fasciotomy closure techniques and reduces the need for STSG. CETE can be used on conjunction with other wound healing therapies such as negative pressure wound therapy (NPWT) and split-thickness skin grafting (STSG). Future studies will focus on cost-benefit and patient outcome analyses comparing CETE with traditional wound closure techniques.

REFERENCES

- 1) Concannon MJ, Puckett CL. Wound Coverage Using Modified Tissue Expansion. *Plastic & Reconstructive Surgery*, 1998, 102(2) : 377-84
- 2) Velmahos GC, Theodorou D, et al. Complications and Non-Closure Rates of Fasciotomy for Trauma and related Risk Factors. *World J Surg*. 1997; 21:247-252
- 3) Fitzgerald AM, Gaston P, Wilson Y, et al. Long-Term Sequelae of Fasciotomy Wounds. *Br J Plast Surg*. 2000; 53: 690-693

The Continuous External Tissue Expander:

The DermaClose® RC is a continuous external tissue expander. It is a new device designed to facilitate wound closure. The device applies a continuous expansion force to the skin adjacent to a full thickness wound and, thus, can facilitate wound edge approximation. The device uses barbed skin anchors (below) which are placed uniformly around the wound and a 'tension controller' (below) that applies a continuous controlled pulling force on a heavy suture that is "laced" to the skin anchors. It does not require additional adjustment after initial application. Once adequate expansion is accomplished, the device is removed and the wound is either sutured or closed by another method.



Skin Anchors:

The flat barbs of the skin anchors insert into the skin 4.5mm and are held in place with two skin staples.



Tension Controller:

The line from the tension controller attaches under the tab of the skin anchors. DermaClose® RC provides a calibrated and controlled amount of force to expand the tissue adjacent to the wound.

