

# Development of a soft tissue reconstructive ladder in trauma patients to improve patient and health care outcomes with the use of negative pressure wound therapy systems and cellular tissue products.

Elizabeth Faust, MSN, CRNP, CSWS, CWOCN-AP, MAPWCA;  
Amanda McNicholas, DNP, MBA, CRNP; Esther J Kim, DO  
Reading Hospital - Tower Health, West Reading, PA

## Background

Soft tissue injuries (STI) most commonly result from an infectious cause, such as necrotizing soft tissue infection or from a traumatic injury. While each patient has unique needs based upon their history, anatomical location, and nature of injury, the care for these patients is often multidisciplinary. Involved stakeholders include: trauma surgeons, wound team, plastic surgery, physical and occupational therapy, and case management. It was identified that the projected treatment guidelines were ill-defined in a Level 1 Trauma Center in Eastern Pennsylvania. The providers and clinicians had limited guidance on timing of advanced therapies such as negative pressure wound therapy (NPWT\*) and negative pressure wound therapy with instillation and dwell (NPWTi-d<sup>†</sup>) followed by grafting. The length of stay for STI patients can be weeks to months in the acute care setting. We proposed a treatment guideline including surgical debridement, NPWTi-d with new fused foam dressing (VFCCC<sup>‡</sup>) and hybrid drape<sup>§</sup>, and application of engineered extracellular matrix (EECM) to improve the outcome for the patient but also the health care system.

## Methods

- Retrospective chart review at a single Level 1 Trauma Center (725 bed) for patients admitted with complex soft tissue wounds in 2022.
- Inclusion criteria:
  - Necrotizing soft tissue infection or traumatic wounds
  - Requiring operative intervention with subsequent operative takeback eventually necessitating NPWT
- Exclusion criteria:
  - Simple abscesses
  - Fasciotomy
  - Death during treatment
- 10 patients were qualified for this study
- Two groups
  - CONTROL GROUP: 7 patients without NPWTi-d and engineered extracellular matrix (ECM)
  - TREATMENT GROUP: 3 patients with NPWTi-d followed by engineered extracellular matrix (ECM) use
- Outcomes assessed: Number of operations, time to closure, number of NPWT changes, number of admissions, number of operative debridements, and length of stay (LOS)

## Results

	LOS (days)	# of admissions	# of Wounds	Initial SA (cm <sup>2</sup> )	# of dermal grafts	# of STSG
Control Group	55	1.71	1.00	303.29	0.29	0.43
Treatment Group	31.67	1.33	1.67	179.33	2.67	1.00

	# of OR trips	# of IP OR trips	Time to closure (days)	# of Debridements	# of NPWT changes	NPWTi-d
Control Group	10.29	10	81.86	5.00	12.57	60%
Treatment Group	12.67	9.67	68.33	6.33	12.33	100%

## Case Study: Forklift crush injury of the left lower extremity

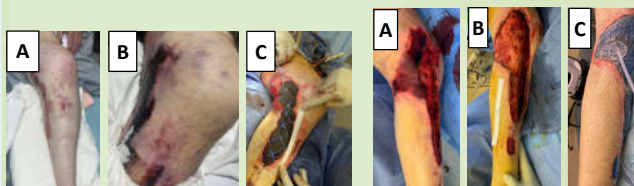


Figure 1A and B: Initial presentation  
Figure 1C: NPWTi-d placement

Figure 2A-C: Before and with VFCCC



Figure 3A, B: After VFCCC  
Figure 3C, D: EECM placement



Figure 4A: Before STSG  
Figure 4B: STSG takedown  
Figure 4C: Closure

## Discussion

- Patients in the Treatment Group showed a decrease (Table) in
  - LOS
  - Number of admissions
  - Number of inpatient operative trips
  - Time of closure
  - Number of NPWT changes
- The use of NPWTi-d with VFCCC prior to EECM helped to decrease the length of hospital stay by 23 days
- Time to closure was decreased by over 13 days in the Treatment Group.
- Patients that were treated with NPWTi-d and EECM did not require as many hospitalizations due to weekly NPWT changes
  - Patients can be discharged to a rehabilitation facility and return as an outpatient to the OR to have their NPWT dressing changed weekly, which explains the increase in number of OR trips in the Treatment Group but the decrease in inpatient OR trips.
- Overall, the use of NPWTi-d with VFCCC and EECM had a positive benefit in complex wound management.

## Conclusion

The authors hypothesize that the incorporation of NPWTi-d use with VFCCC and followed by EECM use for the Treatment Group helped to prepare the wound bed for closure in less time. Given the outcomes of decrease in hospital stay, decrease in time of healing, decrease in NPWT changes, the utilization of NPWTi-d with novel fused foam dressing and hybrid drape followed by application of EECM as a part of a soft tissue reconstructive ladder should be considered as a solution to complex soft tissue injuries for a variety of etiologies and locations.



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