Utilization of Dynamic Pressure Control Mode in Negative Pressure Wound Therapy: Initial Experience

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Introduction

- Negative pressure wound therapy with instillation and dwelling (NPWTi-d) of a topical wound solution has been shown to promote faster rates of wound granulation compared to traditional NPWT without instillation.[1,2]
- Reports of pain and increased solution leaks have limited the use of intermittent mode during NPWT and NPWTi-d.[3,4]
- Dynamic pressure control (DPC) mode is the evolution of the intermittent therapy from previous generations of NPWT devices. It maintains a low level of negative pressure (above 0) at the wound site between cycles for a customized time interval. This mode was designed to reduce leaks and fluid accumulation that can occur when there is no negative pressure at the wound site. It was also introduced to reduce patient discomfort from foam expansion and compression between cycles.[5]

Purpose

- Assess the feasibility of using DPC mode in conjunction with NPWTi-d, a combination that has not been documented in prior publications.

Methods

- Each wound was managed using a multidisciplinary team approach.
- Systemic antibiotics were administered, and sharp surgical debridement was performed prior to or in conjunction with NPWTi-d application.
- Adjunctive NPWTi-d* was applied with hypochlorous acid via a reticulated open-cell foam (ROCF) dressing with through holes†.
- NPWTi-d settings included instillation of 20-90 mL hypochlorous acid every 2 to 3.5 hours with a 10-20 minute dwell time between cycles of negative pressure at -75 to -150 mmHg.
- NPWTi-d units operated in DPC mode; cycle rise times were set from 3 to 8 minutes, and cycle fall times from 2 to 8 minutes.
- At each dressing change, non-contact real-time fluorescence wound imaging was used to determine the presence and location of pathogenic bacteria, and non-contact near infrared spectroscopy studies were performed to measure deoxyhemoglobin, oxyhemoglobin, and ratio of tissue oxygenation.
- Dressings were changed 2-3 times/week.

Table 1. Overview of Cases

Case #	Sex	Age (years)	Comorbidities/history	Wound type	NPWTi-d settings	NPWTi-d duration (days)
1	M	63	Type 2 DM, neuropathy, prior DFUs, PVD, anemia, PAD, venous insufficiency with ulceration, HTN, vascular disease	Arterial and diabetic ulcers	32-90 mL ; 20 min dwell; 2 hours@ -150mmHg; cycle rise time: 3 min; cycle fall time: 3-8 min	60 days over 4 admissions (range: 3-28 days)
2	M	37	Obstructive sleep apnea, PTSD, sustained I foot grade 3 open distal tibial pilon fracture with vascular injury during motorcycle vehicle accident; acquired venous insufficiency	Infected chronic full thickness dehiscence on left posterior calf post surgical calf flap procedures	20 mL ; 20 min dwell; 2 hours @ -125 mmHg; cycle rise time: 3 min; cycle fall time: 8 min	4
3	M	24	Type 1 DM (uncontrolled), neuropathy, diabetic foot ulceration	Diabetic foot gangrenous infection secondary to acute wound	26 mL; 15 min dwell; 3.5 hours @ -125 mmHg; cycle rise time: 3 min; cycle fall time: 3 min	9
4	M	20	Rollover motor vehicle accident	Surgical wounds (n=3)	85 mL; 10-20 min dwell; 3.5 hours@ -75 mmHg (hip), -125 to -150 mmHg (abdomen, elbow); cycle rise time: 3-8 min; cycle fall time: 2-4 min	28

PTSD: post-traumatic stress disorder; DM: diabetes mellitus; HTN: hypertension; DFU: diabetic foot ulcer; PVD: peripheral vascular disease; PAD: peripheral artery disease

Results

- 4 patients with 11 complex wounds were treated (**Table 1**).
- Duration of NPWTi-d ranged from 3-28 days.
- In DPC mode, fewer leaks were observed, compared to prior use of intermittent mode.
- All wounds exhibited a positive wound healing progression during therapy, as evidenced by reduction in nonviable tissue and increased granulation tissue formation.

Conclusions

- Use of DPC was a safe and viable operating mode during NPWTi-d in these 4 cases.
- Compared to our experience with continuous and intermittent modes, clinical results were similar with DPC mode.
- The decreased risk of leaks in DPC mode reduced the necessity for dressing replacement or reinforcement between dressing changes.
- More research is needed to define wound characteristics that would most benefit from NPWTi-d and DPC mode.

References

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4. Li W, Zheng J. Negative pressure wound therapy for chronic wounds. *Ann Plast Surg.* 2024 Aug 1;93(2S Suppl 1):S19-S26.
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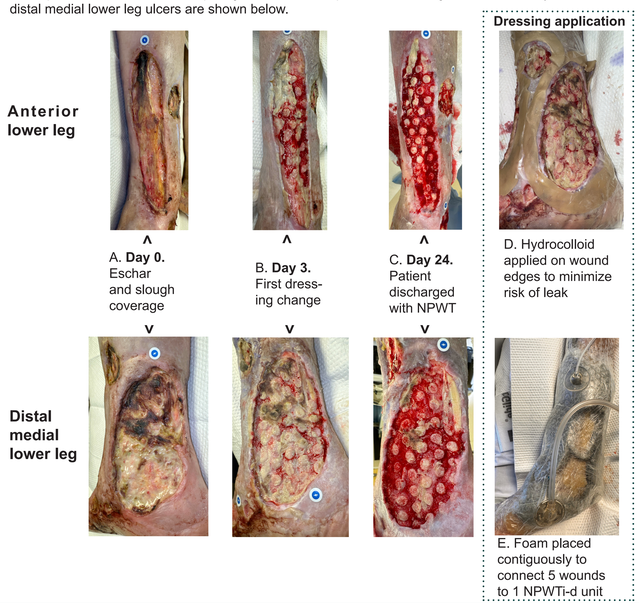
Cases

Case 1. Multiple arterial and venous leg ulcers. 63-year-old male with history of peripheral artery disease, venous insufficiency, hypertension, and uncontrolled diabetes mellitus type 2, with complications of neuropathy, vascular disease and prior diabetic foot ulcers. Presented with 6 heavily infected right leg ulcers (anterior lower leg, proximal medial low leg, distal medial lower leg, proximal medial foot, lateral ankle) present for 2 years secondary to arterial and venous insufficiency and diabetes. Patient reported acute pain and was at risk of requiring above knee amputation on the right distal extremity. Anterior and distal medial lower leg ulcers are shown below.



A. **Day 0.** Eschar and slough coverage

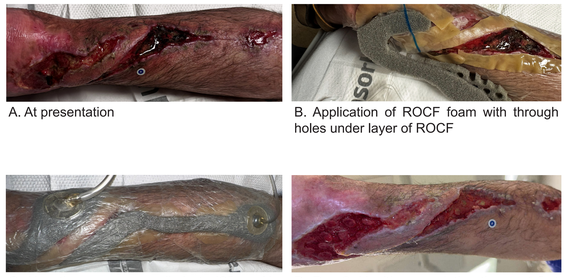
B. **Day 3.** First dressing change

C. **Day 24.** Patient discharged with NPWT

D. Hydrocolloid applied on wound edges to minimize risk of leak

E. Foam placed contiguously to connect 5 wounds to 1 NPWTi-d unit

Case 2. Dehisced flap. A 37-year-old male presented with a failed second stage left leg fasciocutaneous sural flap that was performed 5 months prior to reconstruct a complex nonhealing ankle wound that occurred during a motorcycle accident 2 years before. Patient reported increased pain and purulent drainage. He inquired about an amputation to relieve his chronic pain.



A. At presentation

B. Application of ROCF foam with through holes under layer of ROCF

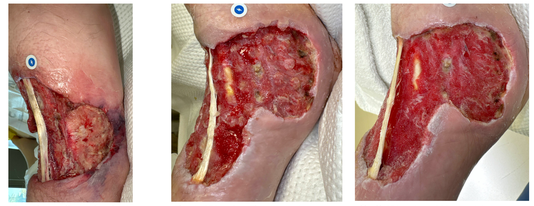
C. Negative pressure applied at -125 mmHg with device in DPC mode. Cycle rise time was 3 minutes and cycle fall time was 8 minutes.

D. **Day 3.** Healthy granulation tissue at first dressing change after 3 days of NPWTi-d. Therapy switched from NPWTi-d to traditional NPWT.

E. **Day 15.** Advancing wound edges and reduced wound size. Therapy changed to hydrogel-based wound dressing, compression and lymph edema pump.

F. **4-Month Follow-up**. Wound is healing and amputation was avoided. Patient no longer experiencing pain from his wound.

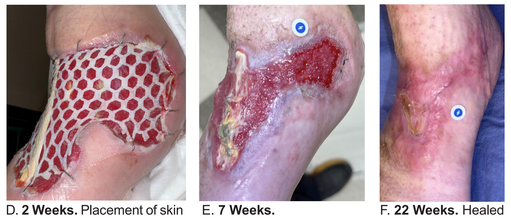
Case 3. Infected diabetic foot wound. A 24-year-old male presented with a gangrenous diabetic foot infection resulting from an acute wound inflicted during an altercation. There were concerns about the possibility of osteomyelitis.



A. **Day 0**. Infected diabetic foot wound at presentation

B. **1 Week.** Reduced areas of nonviable tissue. Therapy changed to traditional NPWT

C. **2 Weeks.** Wound is granulated and prepared for placement of skin subsitute

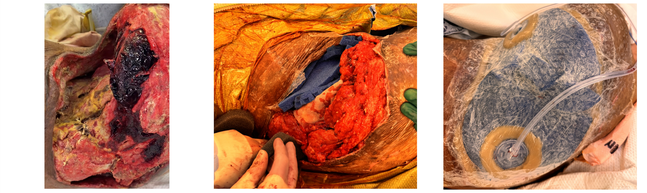


D. **2 Weeks.** Placement of skin substitute, and patient was discharged home with NPWT

E. **7 Weeks.**

F. **22 Weeks.** Healed wound 10 weeks post discontinuation of NPWT

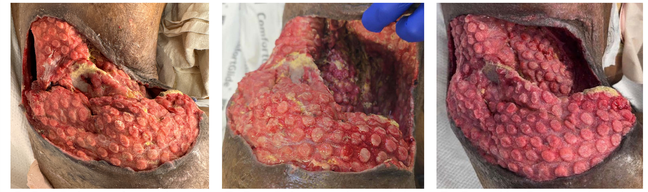
Case 4. Nonhealing surgical wound. A 20-year-old male presented with nonhealing surgical wounds acquired one month prior during a rollover motor vehicle collision. Following exploratory laparotomy, right hemicolectomy, ligation of mesenteric bleed, splenectomy and excisional irrigation and debridement of right hip, NPWTi-d was applied to 3 large wounds located on hip, midline abdomen and right posterior elbow.



A. **Day 0.** Exposed necrotic muscle, bone, and adipose tissue at presentation. Serosanguineous drainage with no odor.

B. ROCF foam placed in areas of undermining

C. NPWTi-d initiated at -75 mmHg in DPC mode. Cycle rise time was 8 minutes and cycle fall time was 4 minutes.



D. **Day 5.** Areas of necrotic tissue were reduced

E. **Day 5.** Increased granulation tissue present with reduced slough and exudate

F. **Day 19.** Decreased undermining and wound covered with thick granulation tissue; patient transferred to LTAC and lost to follow-up

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***Solventum™ Veraflo™ Therapy; †Solventum™ V.A.C. Veraflo Cleanse Choice™ Dressing, Solventum Corporation, Maplewood, MN**

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