Do I Really Understand Negative Pressure Wound Therapy?

Heal on Beal
SCR WOCN Conference
Memphis, Tennessee
October 10-12, 2013

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Disclosure: Ahearn is the Director of Clinical Operations for Prospera.
Objectives

- Define NPWT and acknowledge its evolution.
- Identify NPWT Indications, Contraindications and Precautions.
- Acknowledge influential NPWT Research.
- Define three basic components of NPWT and PROS/CONS of each.
- Identify NPWT protocols.
- Discuss Reimbursement criteria for NPWT.
- Discuss customized NPWT therapy for different wound types.
The Initial Questions
Exploring the Disparity between Science and Current Practice*

Lack of evolution
- Gold Standard
- Previous research: wet-to-dry gauze controls

Compelling evidence
- Intermittent NPWT vs. continuous therapy
- Lower negative pressure – (< -125 mmHg)

Review published research
- Mechanisms of action
- System factors and functions
- Patient comfort and quality of life

More questions than answers

* (Ostomy Wound Management, June 2009)
Definition & History

**FDA approval for ‘vacuum assisted drainage’ (VAD)**

Definition: ‘the application of sub-atmospheric pressure either continuously or intermittently to an open wound’


- 1908 Dr. Meyer and Prof. Schmieden note a hyperemic response of tissue when exposed to suction under a glass cup. Better healing with intermittent.
- 1952 German patent illustrating the use of NPWT with various dressings such as sponge, foam, plastic and gauze.
- 1976 Dr. Paul Svedman develops the Svedman Wound Treatment System with “Svamp Foam”.
- 1986-91 “The Kremlin Papers”, a compilation of 5 studies by Russian clinicians demonstrating the effectiveness of NPWT using gauze and lower pressures.
- 1989 Chariker-Jeter clinical case studies revolutionizing the effectiveness of cutaneous fistulae management by using NPWT and gauze dressings.
- 1990 Dr. David Zamierowski files patent for Wound Dressing and Treatment Method. Later 1993 submits a fastening system over the wound.
- 1993 Dr. W. Fleischman study for Vacuum Sealing as Treatment for Soft Tissue Damage in Open Fractures.
- 1994 KCI enters the market with the “VAC” foam system.
Indications

May promote wound healing by:
- removing excess fluid (infectious and non-infectious)
- stimulating granulation by increasing vascular perfusion
- encouraging wound contraction
- protecting the wound from microbe imbalance
- maintaining a moist wound environment

Acute and Chronic wounds
- Pressure ulcers
- Diabetic/Neuropathic ulcers
- Venous Insufficiency ulcers
- Traumatic
- Post-operative and Dehisced surgical
- Explored fistulas
- Skin Flaps and Grafts
- Full thickness and partial thickness wounds
- Partial thickness burns
Precautions & Contraindications

- Active bleeding or anticoagulant therapy
- Difficult wound hemostasis
- Unstable underlying medical conditions
- Close proximity of blood vessels, organs, muscle, and fascia (requires adequate protection)
- Irradiated vessels and tissue
- Bony fragments
- Untreated malnutrition
- Non-compliant or combative patients

- Wounds containing malignant tissue
- Untreated osteomyelitis
- Necrotic tissue such as slough or eschar
- Unexplored or non-enteric fistulas
- Exposed organs, blood vessels
Evidenced-based Scientific Clinical Research

- **1997** Argenta PhD. and Morykwas MD first published an article proving intermittent pressure provides optimal blood flow patterns at 5 minutes on and 2 minutes off and prove rates of granulation under intermittent pressures out perform continuous pressure 103.4% to 63.3%.

- **2003** Dr. Isago finds no significant differences in the reduction of the wound area with pressure of -50, -75 or -125mmHg and proves reducing the negative pressure to -50 to -75 mmHg relieves pain and does not affect the therapeutic effect.

- **2004** Dr. Wackenfors finds lower negative pressure (-50 to -75mmHg) maximizes blood flow in soft tissue, muscle tissue requires slightly higher pressures. Identifies a zone of hypo-perfusion directly related to the degree of pressure and concludes intermittent therapy as significant.

- **2008** Dr. Malmsjo concludes gauze and foam are equally effective at delivering pressure transduction and wound contraction, mechanical deformation stimulates new tissue formation and foam and gauze to be equally effective in delivering blood to the wound.
2009 Dr. Malmsjo concludes lower and variable negative pressures improve mechanical deformation of the wound edge, wound fluid removal and wound edge micro-vascular blood flow. There is an optimal balance offered by tailoring increasing and decreasing negative pressures (-75 to -80 mmHg/100% blood flow; -40 to -45 mmHg/50% blood flow).

2010 Dr. Borgquist concluded the effects of intermittent and variable negative pressure wound therapy on blood flow at the wound edge are directly related to the degree of pressure transduction.

2011 Dr. Malmsjo concluded tissue trauma during NPWT is directly related to the amount of negative pressure applied and force of removal when the wound filler is removed. This trauma causes release of Substance P and CGRP pain markers.

2012 Dr. Gustafsson expansive research looking at effects of variable, intermittent, and continuous negative pressure wound therapy, using foam or gauze, on wound contraction, granulation tissue formation, and in-growth into the wound filler.
NPWT Ethics Influences Protocols

- Patient Comfort/Quality of Life
  - Less Pain
  - Less Narcotic Use and its Consequences
- Nursing Utilization
  - Time Management
  - Continued Education and In-servicing
- Cost Effectiveness
  - Profitable management within the Financial/Reimbursement parameters.
- Efficacious wound closure
  - Patient Comfort, Nursing management, Cost, Healing
Understanding Components before Protocols

Basic Components of NPWT

- **Pressure**
  - High or low or in-between

- **Filler**
  - Foam, gauze, other

- **Mode**
  - Continuous, Intermittent, Variable
Component PROS & CONS

Pressure

- High versus Low Pressure
  - Gold Standard
  - Easy Compression
  - Hypo-perfusion Halo
  - Tissue Color
  - Contraction and Volume Reduction
  - Exudate Removal
  - Edema Reduction

Graph showing the relationship between negative pressure (-mmHg) and wound contraction (% decrease).
Component PROS & CONS

- **Filler**
  - Pressure Transduction
  - Hydrophobic vs. Hydrophilic
  - Bacterial Load
  - Pain
    - In-growth vs. non-in-growth
    - Force of removal
    - Neuropeptide markers
  - Filler color (black, green, silver, white)
  - Tissue Histology
    - Quantity vs. Quality
  - Two hour limit for NPWT interruption
  - Wear time = cost effectiveness
Component PROS & CONS

- **Mode**
  - Continuous
    - Standard
  - Intermittent
    - Improved granulation
    - Dressing leaks
    - Pain
  - Variable
    - Eliminate negatives
    - Improve healing rates (to be formally studied)
Customize the Components

- Choice of Wound **Filler**
- Reduced Level of Negative **Pressure**
- **Mode** of Therapy

![Gauze and Foam Images]

![Graph of Wound Contraction vs. Negative Pressure]

![Graphs of Continuous, Intermittent, and Variable Therapy Modes]
Using your Components to make Protocol “Guidelines”

- Acute and Chronic wounds
  - Pressure ulcers
  - Diabetic/Neuropathic ulcers
  - Venous Insufficiency ulcers
  - Traumatic
  - Post-operative and Dehisced surgical

- Explored fistulas
- Skin Flaps and Grafts
- Full thickness and partial thickness wounds

- Partial thickness burns

**VPT -80 high/ -40mmHg low
  - 5 min high/2 min low**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pressure Overview</th>
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<tbody>
<tr>
<td>Acute and Chronic wounds</td>
<td>CPT, IPT, <strong>VPT / -80 to -125mmHg</strong></td>
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<td>Venous Insufficiency ulcers</td>
<td><strong>CPT -80 to -125mmHg then VPT</strong></td>
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<td>Partial thickness burns</td>
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**Dressing changes 2-3 x per week**
NPWT Reimbursement

- E2402 - Pump
- A6550 - Dressing Kit
- A7000 - Canister

Part B Medicare/Competitive Bidding 7/1/2013
(Austin, Texas example location)
- E2402 - $751.26/$25.04
  - 30 days
- A6550 - $261.80/$24.12
  - 15 kits/mo.
- A7000 - $77.60/$7.76
  - 10 can./mo.

$ 1090.66/month
$ 36.36/day

Part B Wound Criteria
- Previous protocols
- Date/Type of debridement
- 0.5 cm or > depth
- Nutritional status
- Diabetic program
- Chronic wound >30/days
- Initial measurements
- Pressure/Chronic
  - Turned, relief, moisture
- Vascular
  - Compression, elevation
Do I Really Understand NPWT?

YES!!!!
What’s My Protocol?

Diabetic Charcot Foot       Sacral Pressure Ulcer
What’s My Protocol?

- Traumatic Leg Wound
- STSG Graft
What’s My Protocol?

- Neuropathic DM Toe
- Transmetatarsal Amputation
What’s My Protocol?

- Exposed Structure
- Open Organ
What’s My Protocol?

- Open Abdomen
- Abdomen with Slough
What’s My Protocol?

- Dehisced Post Op
- Foreign Body
NPWT References

- Clare MP, Fitzgibbons TC, McMullen ST, Stice RC, Hayes DF, Henkel L. Experience with the vacuum assisted closure negative pressure technique in the treatment of non-healing diabetic and dysvascular wounds. Foot Ankle Int 2002 Oct; 23(10): 896-901.
NPWT References


NPWT References


Reitsma, Angelique M., M.D. and Rhodeheaver, George T., Ph.D, Effectiveness of a New Antimicrobial Gauze Dressing as a Bacterial Barrier;University of Virginia Health System, Charlottesville, Virginia. 9/2001


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- Webb LX. New techniques in wound management: vacuum-assisted wound closure.

