Foundations In Wound Care for the Non-Wound Care PT

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Objectives

Participants will be able to:

discuss the role of physical therapy in wound management

identify the components of a comprehensive wound assessment

compare and contrast inflammation and infection

describe and document the characteristics of a wound

Historical evidence of wound care

2000 B.C.
- Clays, oils, mud to protect and absorb
- Honey, vinegar to clean

18th century
- Surgical techniques

19th century
- Aseptic technique
- Modern wound dressings

Google images

“I didn’t know PTs did wound care!”

Google images

WW1

- Massage, whirlpool therapy

WW2

- Biophysical agents

2017

- APTA publishes white paper, “The Role of the Physical Therapists in Wound Management” (ACEWM)

Assessment of the Patient with a Wound

“Wounds are always the symptom of something else” - Carolyn Fife, MD

Think:

Vascular status

Infection

Nutrition

Pressure or trauma

Key questions in the history

"Is this getting better or worse?"
- Onset date
- Any fever, signs of infection
- Allergies – contact, medication, food
- Complicating factors
- Functional limitations

"How are you sleeping and eating?"
- Psychosocial factors

"What has been the care been to date?"
- Last dressing change
- Supplies
- Any support at home

Clinical screening of vascular status

If hydration is poor, profusion is poor

Rubor of dependency test

- Elevate limb until pallor then place dependent, longer than 30 sec is sign of ischemia

Venous filling time

- Same technique, look for venous distention, normal is 5-15 seconds

Capillary refill test

Ankle brachial index

- Values less than <1.0 indicate ischemia, severe if <.5

Laboratory values (Normal)

HbA1c	4 - 6%
Albumin	3.5 - 5.5g/dL
Pre-albumin	20 - 40g/dL
Hemoglobin	13 - 18g/dL (male) 12 - 16g/dL (female)
Creatinine	0.6 - 1.5g/dL

Phase of healing or sign of infection?

Normal phases

- Inflammatory
- Proliferative
- Remodeling

Cardinal signs of infection

- Increasing pain
- Increasing odor
- Increasing warmth
- Increasing edema
- Increasing redness

Key Objective Measures in the Wound Exam

Tissue composition

Periwound assessment

Drainage

Wound measurement

Edema (girth)

Wound outcome measurement tool

- Bates Wound Assessment Tool (BWAT)- 13 Items, 60 point scale

Tissue Composition by Percentage

Granulation tissue and slough

Eschar

Tissue Composition
Anatomical structures

Pay Attention to the Periwound!

Drainage

Serous

Serosanguineous

Sanguineous/bloody

Purulent

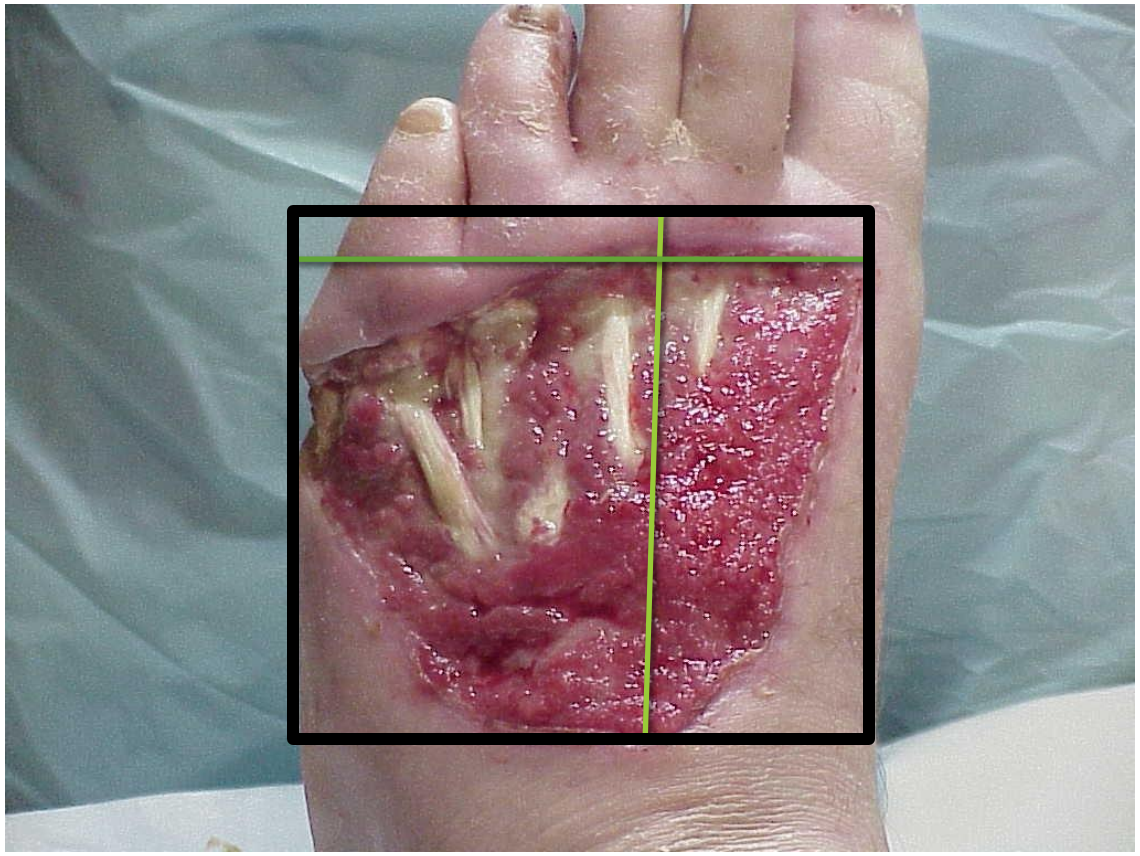
- Consistency
  - Watery
  - Viscous

Wound measurement

Surface area

- Usually a linear measurement
- Greatest length by greatest width
- Clock method (12-6 and 3-9)
- In centimeters (cms)

Greatest Length x Greatest Width



Depth - probe centrally and for sinus tracts

Undermining and Tunneling

Edema

Circumferential measurements

Measure both limbs

Palpation

Remember to assess the impact of the wound on the whole person:

Sensation

Pain

ROM

Strength

Gait and mobility

Google images

Establishing a baseline for intervention

Wound management goals:

- Decrease the percentage of necrotic tissue/increase granulation tissue
- Reduce edema by _____ cm or to proportional to uninvolved limb
- Decrease the wound depth or undermining by _____cm
- Drainage to be proportional to wound and serous/serosanguienous in nature
- Reduce wound surface area by __ cm^2
- Complete re-epithelialization of the wound surface

Physical Therapist Assistant's Role in Wound Care

MARIE R. ADAMS, PTA

Physical Therapist Assistant (PTA) & Wound Care

Each state has different laws and regulations in regards to debridement and modalities

Follow each state's Physical Therapy Practice Act and Scope of Practice

Pennsylvania is fairly vague and can be open to interpretation

pennsylvania
DEPARTMENT OF STATE

PT & PTA Relationship

Physical therapist (PT) is only able to delegate tasks to PTA that:

- "He is educated to perform subject to limitations in this section," (PA Practice Act – 40.53.a)
  - Meaning: A PT is only allowed to delegate a task that he is able to perform within the PA Practice Act
- "Therapeutic techniques and procedures beyond the skill and knowledge of the physical therapist assistant," (PA Practice Act – 40.53.b.5)
  - Meaning: A PT is only allowed to delegate a task if the PTA received proper education and training

PTA Education & Training

A two-year Physical Therapist Assistant Associate Degree

Curriculum is regulated by CAPTE (Commission on Accreditation in Physical Therapy Education)

Each school may teach different debridement techniques

Lehigh Carbon Community College (LCCC) teaches debridement with forceps and scissors

- Not scalpels

PTA Education & Training

PTAs may receive further education from:

- Continuing Education courses
- On site job training from a licensed PT

The formal education and training fulfills this portion of the Practice Act for PTAs

- "A physical therapist assistant may perform only activities for which the physical therapist assistant has received formal education and training," (PA Practice Act – 40.171.a)

Pennsylvania PA Practice Act

Positives

- Able to be interpreted to each therapist
- Allow PTAs to receive further education in wound care and debridement if interested
  - Should have a supervising PT who is properly educated in wound care and debridement

Negatives

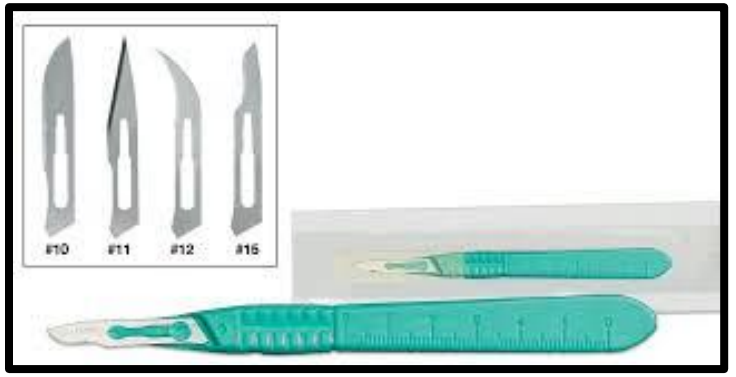
- Able to be interpreted to each therapist
- Vague and unclear
- Only deal with issues concerning ethical and quality standards of conduct in the context of disciplinary action

Pennsylvania PA Practice Act

Highly recommended to have further education and training documented in case of a disciplinary action

If you do not feel comfortable with wound care or debridement, **DO NOT DO IT!**

Discuss with supervising PT



Management of Wound Environment with Dressings & Topical Agents

Objectives

Review goals of wound care

Explain the goals of wound dressings

Select and administer appropriate dressings

Goals of Wound Care

Protect wound and surrounding tissue from further trauma

Reduce strain on tissues surrounding wound

Reduce the number of potential harmful microorganisms in and around the wound

Expedite the healing process

Goals and Characteristics of Ideal Dressings

Maintain a moist environment

Protect wound and periwound

Assist and accelerate the healing process

Minimize infection

Minimize contamination from outside

Free from contamination (sterile)

Goals and Characteristics of Ideal Dressings

Manage exudate

Allows for gaseous exchange

Easy to apply and remove

User friendly

Cost effective

Aim to not require secondary dressings

Remain in place while mobile

Wound Assessment

Various wound characteristics may affect the type of dressing that would be used

- **Etiology/history** → type of wound; success rate of previous dressing?
- **Location** → may need secondary dressings in addition to primary dressings
- **Wound measurements** → amount of dressings needed
- **Tunneling and/or undermining** → proper type of dressing to fill
- **Exposed structures (ligament, tendon, bone)** → certain dressings to protect
- **Amount and type of exudate** → how to best manage drainage

Wound Assessment

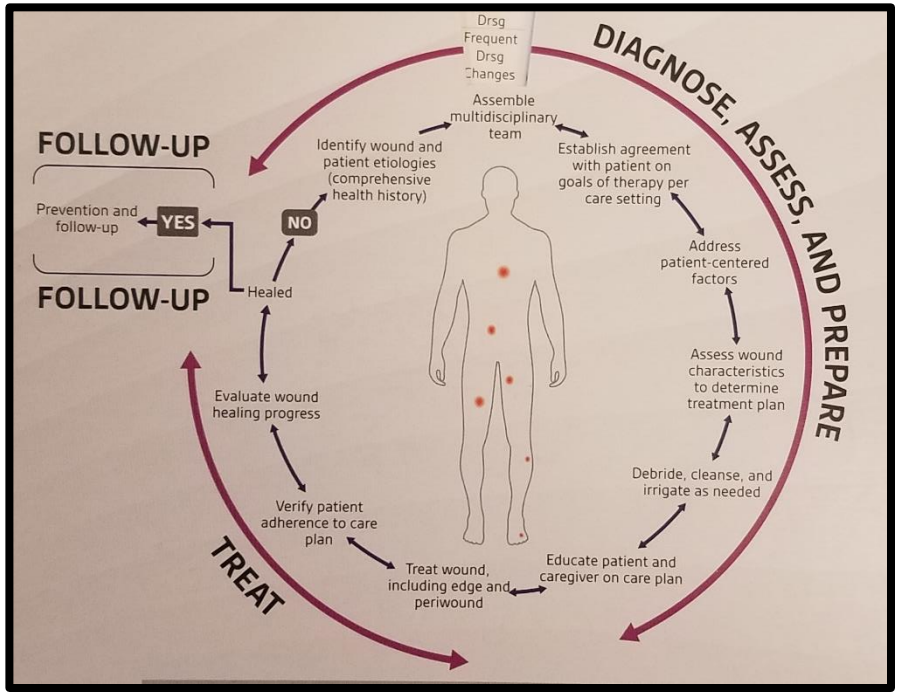
Tissue types → granulation, epithelialization, slough, eschar

- Debridement needed?

Wound edges → attached or detached; defined or undefined

Periwound skin → protect area and prevent maceration

Infection or ischemia → observe for any signs and symptoms



Primary vs. Secondary Dressings

Primary Dressings

- A dressing that is in contact with the wound bed (also called contact layer)
- Purpose is to manage exudate by being absorbent
- Aim to be non-adherent
- Most primary dressings have self-adhesive and do not require a secondary dressing

Secondary Dressings

- A dressing that is covering the primary dressing
- Purpose is to secure and protect primary dressing

Some dressings are used as both Primary and Secondary dressings

Types of Dressings

Alginates

Foams

Hydrocolloids

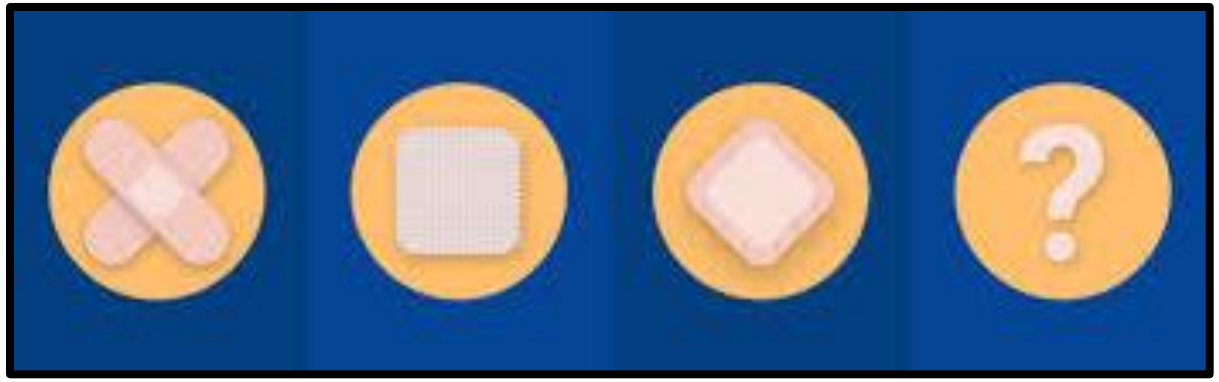
Films

Hydrogels

Gauze

Impregnated Gauze

Silver Dressings



Calcium Alginate Dressing

Calcium or calcium sodium salts of alginic acid

Acids are from seaweed

Produces a hydrophilic gel

Variety of types available (sheets, ropes, packing)

Primary dressing

Calcium Alginate Dressing

POSITIVES

Highly absorptive
- Beneficial for high exudate management

Provides moist environment

Autolytic debridement

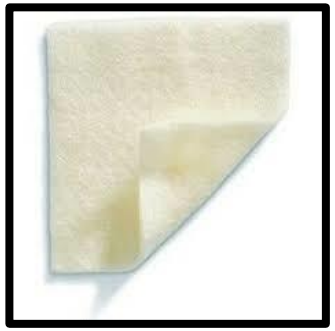
Non-adherent to wound bed

Able to use with infected wounds

Conforms to majority of wounds

Fewer dressing changes

NEGATIVES



Needs secondary dressing to secure

Easily displaced

Turns into gel
- Could be mistaken as infection

Inability to observe and monitor the wound

Not beneficial for dry wounds

Foam Dressings

Single or multiple layers of polyurethane

Different thickness and absorption levels

May be impregnated with charcoal

May have a waterproof backing

Absorb exudate

Variety of types available

- Semi-permeable

Primary or secondary dressings

Foam Dressings

POSITIVES

Highly absorptive

Provides moist environment

Non-adherent to wound bed

Protection

Conforms to majority of wounds/body

Does not need a secondary dressing (if have adhesive backing)

NEGATIVES

Patients may be sensitive or allergic to adhesive backing

Inability to observe and monitor the wound

No autolytic debridement

Not beneficial for very dry wounds

Not beneficial for deep wounds

Hydrocolloid Dressing

Backing of polyurethane foam or film that is gel-forming

When hydrocolloids are placed in wound, exudate and polymers form a gel mass

- Gel mass is usually yellow and malodorous, which does not mean infection

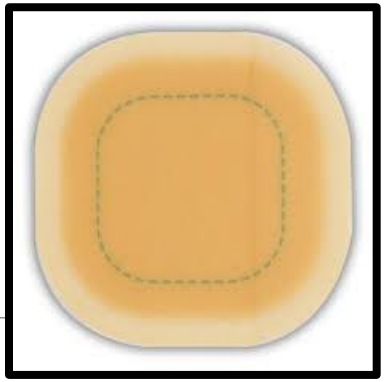
Range from occlusive to semipermeable

Variety of types available

- Self-adhesive mass, granules, paste, powder

Primary dressing

Hydrocolloid Dressing



POSITIVES

Provides moist environment

Autolytic debridement

Minimal to no harm to viable tissue

Waterproof, impermeable, occlusive

Multiple types, shapes, sizes

Does not need a secondary dressing

NEGATIVES

Could macerate surrounding tissue

Could tear fragile skin

Turns into gel

- Could be mistaken as infection

Inability to observe and monitor the wound

Cannot be used on infected wounds

Film Dressings

Thin membranes that are coated with acrylic adhesive

Permeable to moisture vapor and oxygen permeable

Impermeable to moisture and microorganisms

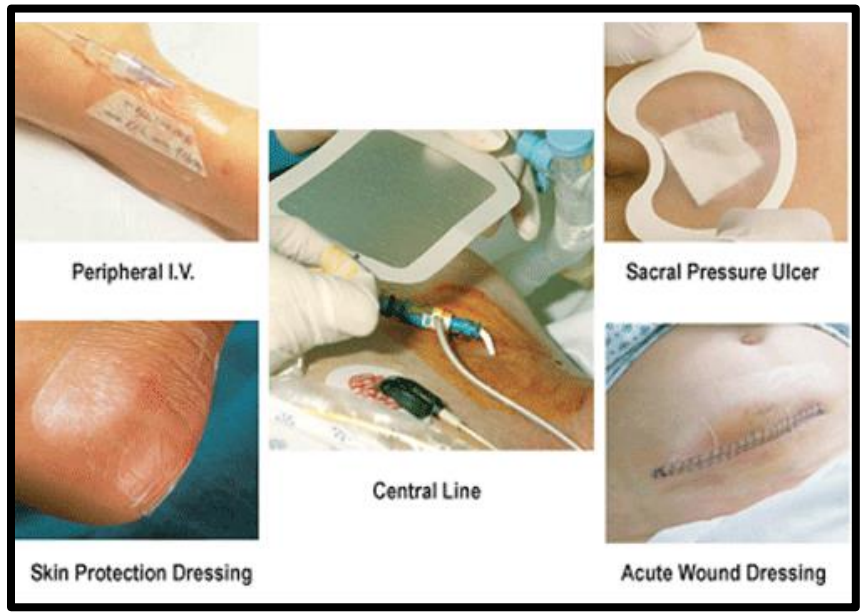
Waterproof

Not absorbent

Variety of types available

- Semi-permeable, semi-occlusive, sizes

Secondary dressing



Film Dressings

POSITIVES

Provides moist environment

Enables autolytic debridement

Protection

Breathable

Conforms to majority of wounds/body

Decreased dressing changes

Multiple uses

NEGATIVES

Not appropriate for managing exudate

Not absorbent

Cannot be used on infected wounds

Could tear fragile skin

- Would need a skin barrier

Difficult to apply

Hydrogel Dressings

Complex organic polymers with 30 to 90% water content

Usually used for dry and sloughy wounds to donate water

Assists in autolytic debridement

Available in gel or sheets

May have additives (i.e. silver)

Absorbs some exudate

Hydrogel Dressings

POSITIVES

Provides moist environment

Autolytic debridement

Non-adherent to wound bed

Absorbs minimum to moderate exudate levels

Allows for visual monitoring

Minimal to no damage to wound and surrounding tissue

Allows for less pain when removing the dressing

Decreased dressing changes

NEGATIVES

Needs secondary dressing to secure

Cannot be used on infected wounds

Gauze

Fibrous, cotton material

Variety of types available

- Rolls, sponge pads

Usually loosely woven

Used to fill cavities in wounds

Used for wet to dry dressings and wet to moist dressings

Gauze

POSITIVES

Highly absorbent

Adherent to wound bed (only if non-selective debridement is desired)

Used to fill in cavities

Inexpensive

NEGATIVES

Does not allow for optimal healing

- Cooler temperatures

Permeable to bacteria

- Higher risk of infection

Adherent to wound bed (only if debridement is NOT desired)

- Re-injury to wound bed

Sheds easily

Frequent changes

May have more pain when removing the dressing

Impregnated Gauze

Enhanced gauze dressing

Impregnated with petroleum or other agents

- Iodine, zinc, silver, saline, hydrogel

Used on superficial, granulating tissue

Impregnated Gauze

POSITIVES

Non-adherent to wound bed or surrounding tissue

Allows for less pain when removing the dressing (since it does not adhere)

Both semi-permeable and semi-occlusive

Able to use with infected wounds

More occlusive than regular gauze

NEGATIVES

Needs secondary dressing to secure

Not appropriate for managing exudate

No drainage absorption

Could possibly delay epithelial migration

Not the most occlusive dressing

Silver Dressings

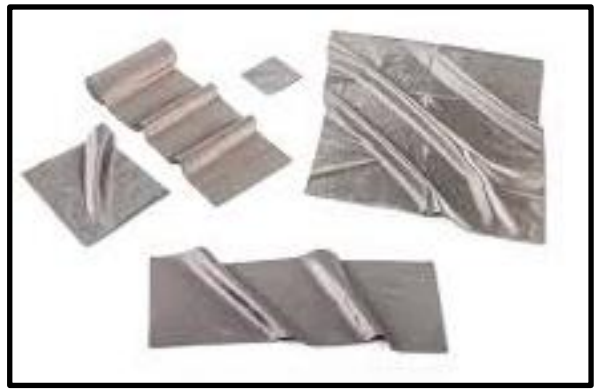
Can be added to various dressings to act as an antimicrobial

- Hydrocolloids
- Alginates
- Foams
- Gels

Amount of silver and mode of action are different in each dressing

- Release silver into wound
- Maintain silver in dressing to kill bacteria

Assist with reducing the risk of infection



Which Dressing Should I Choose?

Wounds are dynamic

Since the wound is healing and changing, the dressing will change as well

Three major aspects of wound that affect dressing choice

- Color
- Depth
- Exudate (amount and type)

Various tools and charts available to help determine dressing

Dressings for Wound Protection

Semi-Occlusive — Wound Protection — Occlusive

Permeable — Impermeable

- Gauze
- Transparent Films
- Non Adherent
- Alginate

- Foam
- Adhesive Dressings
- Island Dresings
- Hydrocolloids
- Silicone
- Petrolatum
- Impregnated Gauze

Dressings for Moisture Management

\- Reduce — Maintain Moisture — Increase +

Low Occlusion	Semi-	High Occlusion
Gauze	Hydrofibers	Impregnated Gauze
Alginate	Hydrocolloids	Hydrogels
Foams	Saline Gauze	Hydrocolloids
Hydrofibers	Wound Fillers	Transparent Films
Gelling Fibre		Island
Protease		Non Adherent
NPWT		
TNP		

Dressings for Debridement


Gauze


Foams


Hydrocolliod


Alginate


Honey

Collagenase

Non-Selective — Debridement Continuum — Selective

Mechanical	Autolytic	Enzymatic
Gauze	Foams	Collagenase
Saline Gauze	Hydrogel	Papina
Monofilament Fiber	Hydrocolloids	Honey
	Alginates	
	Honey	
	Cellulose	
	Transparent Films	
	Amorphous Gel	

	Wound type	Treatment aim	Treatment options	
	**Necrotic wound***	**Dry necrosis** • Protection from further damage • Observation for signs of infection **Wet necrosis** • Debride • Remove eschar	• **Hydrogels** with caution, • **Non-adherent dressing** • **Surgical debridement**	***NB**- most patients with wounds containing necrotic and sloughy tissue will autolytically (naturally) debride. This will normally cause increased levels of exudate and odour and this will need to be managed to prevent excoriation and maceration. In diabetes and peripheral vascular disease keep dry
	**Sloughy wound***	• Remove slough • Provide clean base for granulation tissue	**Low Exudate** • **Hydrogels** with caution, • **Foams** • **Desloughing agent**	**High Exudate** • **Hydrofibres** • **Foams** • **Absorbent pads / super absorbents**
	**Malodorous / infected wound**	• Reduce bacterial load in the wound • Prevention of spread of infection	Consider topical metronidazole gel to reduce malodour	
	**Granulating wound**	• Provide healthy base for epithelialisation	**Low Exudate** • **Non-adherent dressings** • **Foams**	**High Exudate** • **Hydrofibres** • **Foams** • **Absorbent pads / super absorbents**
	**Epithelialising wound**	• Wound maturation	**Low Exudate** • **Hydrocolloids** • **Films** • **Foams** • **Non-adherent dressings**	

Type of Dressing	Minimal Exudate	Moderate Exudate	Heavy Exudate	Usual Dressing Change
Alginate	Not Covered	Full Thickness		once daily
Collagen	Full Thickness		Not Covered	up to 7 days
Composite	Not Covered	Any		up to 3 times week
Contact Layer	Any			1 time week
Foam	Not Covered	Full Thickness		up to 3 times week
Gauze Impregnated	Any			once daily
Gauze Non-Impregnated (no border)	Any			3 times day
Gauze Non-Impregnated (border)	Any			once daily
Hydrocolloid (cover/filler)	Any		Not Covered	up to 3 times week
Hydrogel (no border)	Full Thickness	Not Covered		once daily
Hydrogel (border)	Full Thickness	Not Covered		up to 3 times week
Hydrogel filler	Full Thickness	Not Covered		3 units per wound/per 30 days
Specialty absorbative (no border)	Not Covered	Full Thickness		once daily
Specialty absorbative (border)	Not Covered	Full Thickness		every other day
Transparent Film	Partial Thickness or Closed	Not Covered		up to 3 times week
Wound Filler	Any			once daily
Wound Pouch	Any			up to 3 times week
Zinc Paste Impregnated Bandage	Any			1 time week

Conclusion

Wounds are dynamic

Ideal dressing characteristics and goals

Wound assessment needs to occur in order to determine type of dressing

- Multiple factors

Can discuss with supervising PT if unsure which dressing to choose

Various types of dressings available

- Alginates
- Foams
- Hydrocolloids
- Films
- Hydrogels
- Gauze
- Impregnated Gauze

Various tools available to assist with determining best dressing

Management of Wound Healing with Biophysical Technologies and Debridement

TJ SHAUGHNESSY, PT, DPT, CWS

Objectives

Design a physical therapy plan of care using the DIME treatment strategy

Determine the safest, most appropriate debridement option for you and your patient

Select and administer appropriate dressings and interventions

Provide essential patient education

DIME

D – Debridement / devitalized tissue

I – Infection / inflammation

M – Moisture balance

E – Edge preparation

Debridement

Debridement

Removal of necrotic tissue or foreign debris:

- Promote wound healing
- Release tissue cytokines
- Stimulate growth factors

Photo courtesy of K Wientjes, DPT

Types of Debridement

Sharp

Mechanical

Autolytic

Enzymatic

Biosurgical

Sharp Debridement

- Removal of **non-viable** tissue:
  - Curette
  - Scalpel
  - Scissors
  - Forceps

Sharp Debridement Instruments

Types of Scalpels

#10 – Used mostly for making a variety of incisions by PTs or for pearing hyperkeratotic tissue

#11 – used mostly in surgery for stab incisions (abscesses, chest tubes, etc.)

- Can be used for modifying orthotics and specialty shoes

#15 – Most common for debridement by PTs

Debridement: Before and After

Photos courtsey of K Wientjes, DPT

Stop debriding if:

There is impending bone or tendon

There is bleeding

You are close to a fascial plane or other structure

You are nervous

“What if I don’t feel comfortable doing sharp debridement?”

Sharp Debridement: *Indications and Contraindications*

KNOW YOUR ANATOMY

Indications:

- All necrotic wounds; moist necrotic wounds are best
- If wound has dry eschar, autolytic or enzymatic debridement may be used first to soften necrosis

Contraindications

- Do not perform if you don't feel comfortable or know what you are cutting!
- Clean wounds
- Dry gangrene
- Dry ischemic wounds

Mechanical Debridement

The use of some outside force to remove dead tissue

- “Wet to dry”
- Pulsed Lavage with suction
- Whirlpool

“Wet to dry”

Disadvantages outweigh potential benefits

- Non-selective
  - May remove healthy tissue as well
  - Can traumatize granulation tissue
- Rarely applied correctly
- Painful removal
- May cause maceration of intact skin
- May release airborne organisms and cause cross contamination

Pulsed Lavage with Suction

Cleansing and debridement

Stimulation of granulation tissue

PLWS Considerations

- PPE
  - Eye protection, gown, gloves in a CLOSED environment
  - Wipe down all horizontal surfaces following treatment
- 4-15 psi
  - Utilize lower pressure when tunneling/undermining present
  - Delivers fluids with enough force to separate and remove necrotic tissue yet, does not drive bacteria into wound tissues
    - 4-6 psi = low (use on precaution areas)
    - 7-12 psi = medium (infected wounds)
    - 12-15 psi = high (very contaminated wounds)
- Negative pressure
  - Applies non-compressive mechanical forces to the tissues and dilates arterioles
  - Also removes debris, bacteria and irrigant

PLWS

Precautions

- Decreased sensation
- Patients taking anticoagulants

Contraindications

- Exposed nerves, tendons, arteries or bones
- Facial wounds
- Wounds that are ACTIVELY bleeding
- Body cavities or recent grafts

PLWS Benefits

Cost effective when OR is not needed

Improved patient comfort

Periwound maceration avoided

Treatment may be indicated when WP is not

- Unresponsiveness
- Cardiopulmonary compromise
- Venous insufficiency
- Neuropathy
- Fever/Isolation precautions

PLWS

Whirlpool

No longer viable modality

WP associated risks

- Wound infection
  - Cross contamination
- Risk of tissue damage
  - Supersaturates
  - pH between 5-6 is unfavorable to most microflora – maceration changes the pH
- Mechanical effects on circulation caused by agitation are small
- Dependent position

Whirlpool

Advantages

- Multiple extensive wounds
- Wounds with debris
- Wounds not able to be treated with PLWS

PLWS versus WP

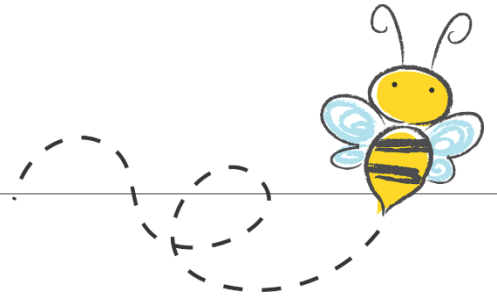
Whirlpool	Pulsed Lavage with Suction
Dependent position of limbs	Position of comfort for patient
Warm water (increased edema)	Room temp saline solution
Turbine speed may be detrimental to healthy tissue, may drive bacteria into wound	Speed is controlled, < 15 psi safe for healthy tissue and bacterial penetration
Non-selective to limb	Non-selective to wound, protects intact epithelium
Macerates intact epithelium	Preserves intact epithelial integrity
Increases risk of water-borne infections	Single use items
Cross contamination of multiple wounds	Cross-contamination risk decreased

Autolytic Debridement

Process of using the body's own mechanisms to remove non-viable tissue

- May be accomplished by use of any moisture retentive dressing
- Hydrogel
- Hydrocolloid
- Transparent film
- Foam
- Manuka honey – from NZ, named after Manuka bush
  - Antibacterial - Methylglyoxal (MD) is cytotoxic and is a small molecule that may pass more easily into the skin and bacteria

Manuka Honey



Acidic pH promotes healing

- Honey has pH between 3.2 and 4.5
- Encourages the blood to release oxygen, reduces presence of proteases that impair the wound healing process

Sugar has an osmotic effect

- Draws water out of damaged tissues, reduces swelling and encourages the flow of lymph to heal wounds
- Draws water out of bacterial cells, which can help keep them from multiplying

Antibacterial effect

- Against MRSA and vanco-resistant enterococci (VRE)

Autolytic Debridement

Advantages

- Non-invasive
- Progress can be determined quickly
  - There should be observed progress within 6 days
- Relatively low cost
- Effective in combination with other debridement techniques
- Safe and effective on diabetic foot ulcers

Disadvantages

- Caregiver education
  - Patient and clinician must be informed and aware of wound appearance, odor and exudate under the dressing, as this can be disturbing

Enzymatic Debridement

Uses enzymes to remove necrotic tissue

- These enzymes digest and dissolve necrotic tissue by breaking down:
  - Collagen
  - Elastin
  - Other parts of devitalized wound matrix in the wound bed

Enzymatic Debridement

Photos courtesy of K Wientjes, DPT

Enzymatic Debridement

Types of enzymes

- Collagenase - Santyl
- Papain-urea
- Papain-urea in combination with chlorophyllin

Usage

- Not active in dry environments, most are not intended for use on dry eschar without proper prep of the eschar
  - Eschar must be cross-hatched with a scalpel and wound surface must be kept moist for the preparations to be successful

Enzymatic Debridement

Advantages

- Selective, working only on necrotic tissue
- Effective when combined with other debridement techniques, such as sharp debridement and autolytic debridement
- Non-invasive

Disadvantages

- Slow to show results
- Can be costly

Biosurgical Debridement

Application of disinfected maggots to the wound to remove non-viable tissue

Lucilia sericata or *Phaenicia sericata* fly larvae

- Secrete proteolytic enzymes that break down necrotic tissue and ingest liquified tissue
- The secretions also have antimicrobial properties

Generally left in the wound for 1-4 days

Debridement Conclusions

Three characteristics of evaluating the effectiveness of debridement

Type of necrotic tissue

- As necrotic tissue is rehydrated, the appearance will change from a dry, desiccated eschar to a more soggy, soft slough, and finally to a mucinous, easily dislodged tissue

Amount of necrotic tissue

- Should diminish progressively if therapy is appropriate

Adherence of necrotic tissue

- Should decrease as debridement proceeds

**Outcome measures for necrotic tissue are specific to type of debridement used during treatment*

When to Use…

Wound Type	Tissue Type	Consistency	Adherence	Amount of Debris	Debridement choices
Pressure	Black/Brown Eschar	Hard	Firm, attached to all edges of wound	75-100% covered	1. Autolytic (transparent film) 2. Enzymatic
	Black/Brown eschar or yellow/tan slough	Soft, soggy, stringy	Adherent, attached to wound base, may or may not be attached to wound edges	50-100% covered	1. Autolytic (hydro colloids/hydrogels) 2. Enzymatic 3. Sharp
	Yellow/tan slough	Soft, stringy	Adherent, attached to wound base (loosely)	Less than 50% wound covered	1. Autolytic (hydro colloids/hydrogels) 2. Enzymatic 3. Sharp
	Yellow slough	Mucinous	Loosely adherent	50-100% wound covered	1. Autolytic (hydro colloids/hydrogels) 2. Enzymatic 3. Sharp

When to Use…

Wound Type	Tissue Type	Consistency	Adherence	Amount of Debris	Debridement Choices
Venous Disease Ulcers	Black/brown eschar	Hard	Firmly adherent, attached to all wound edges	50-100% wound covered	1. Autolytic (hydro colloids/hydrogels) 2. Enzymatic
	Yellow slough	Soft, soggy or fibrinous	Firmly adherent, attached to all wound edges	50-100% wound covered	1. Autolytic (hydro colloids/hydrogels) 2. Enzymatic 3. Sharp
	Yellow slough	Fibrinous or Mucinous	Loosely adherent	Any amount of wound covered	1. Autolytic (hydro colloids/hydrogels) 2. Enzymatic

When to Use…

Wound Type	Tissue Type	Consistency	Adherence	Amount of Debris	Debridement Choices
Arterial	Black/Brown eschar	Hard	Firmly adherent, attached to all wound edges	50-100% wound covered	1. Autolytic (hydro colloids/hydrogels) 2. Enzymatic
		Soft, soggy	Adherent, attached to wound base, may or may not be attached to edges	50-100% wound covered	1. Autolytic (hydro colloids/hydrogels) 2. Enzymatic

When to Use…

Wound Type	Tissue Type	Consistency	Adherence	Amount of Debris	Debridement Choices
Neurotropic/ Diabetic Ulcers	White/Gray	Hard	Hyperkeratosis, callus formation	Involved all/partial wound edges	1. Sharp 2. Autolytic to soften callus formation

Debridement Billing

97597 – Debs

- High pressure waterjet with/without suctions, sharp selective debridement with scissors, scalpel and foceps, including topical applications, use of whirlpool, when performed and instructions for ongoing care, per session, total wounds surface area ***first*** **20 cm^2 or less**

97598 – Debs2

- ***Each*** additional 20 cm^2

MUST CHARGE BOTH TOGETHER if GREATER than 20 cm^2

Debridement Billing

Determining size of debridement

- Calculate the size of your wound
- Multiply the size of your wound by you percentage of devitalized tissue
- Choose < or > than 20 cm^2

- Example
  - Wound size = 20.2 cm x 4.5 cm = 90.9 cm^2
  - **Wound appearance is 80/20**
    - **90.9** cm^2 **x .20 = 18.18** cm^2
    - Charge Debs 97597

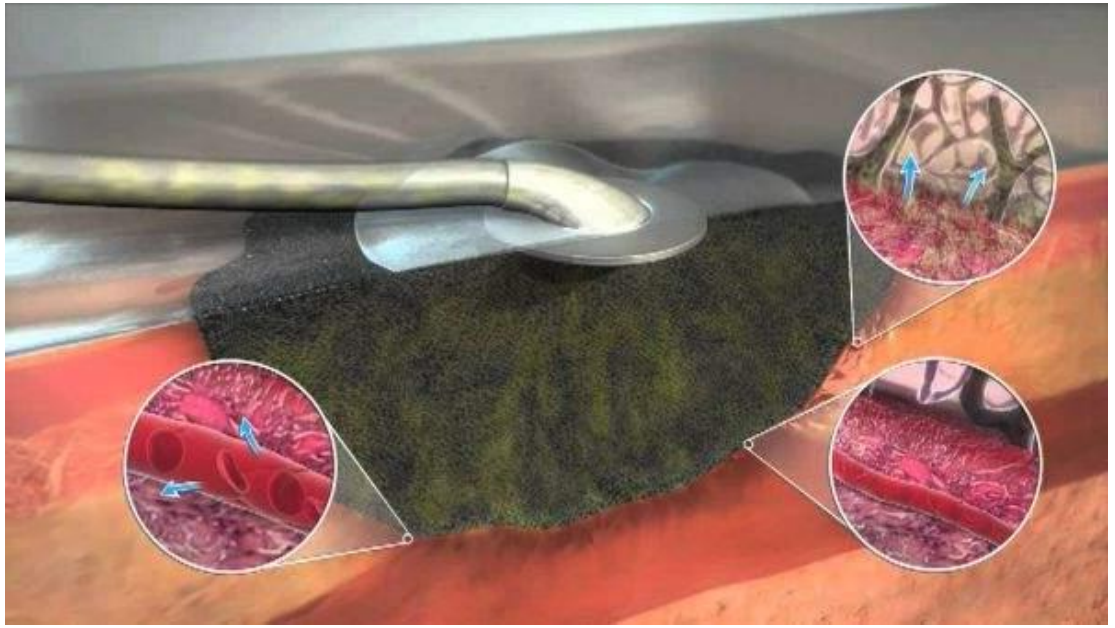
Biophysical Technologies

Negative Pressure Wound Therapy (NPWT)

NPWT

Rationale

- The constant suction on the tissues accelerates growth
- Removal of drainage
- Improves blood circulation and delivery of necessary nutrients and growth factors



NPWT Application

- Foam should only contact the wound bed, not intact skin
- Cut a quarter-sized hole in the drape for connection tubing

Cut smaller pieces of plastic to go around curves

Minimize wrinkles in the drape

Anchor tubing to the patient if patient is ambulatory

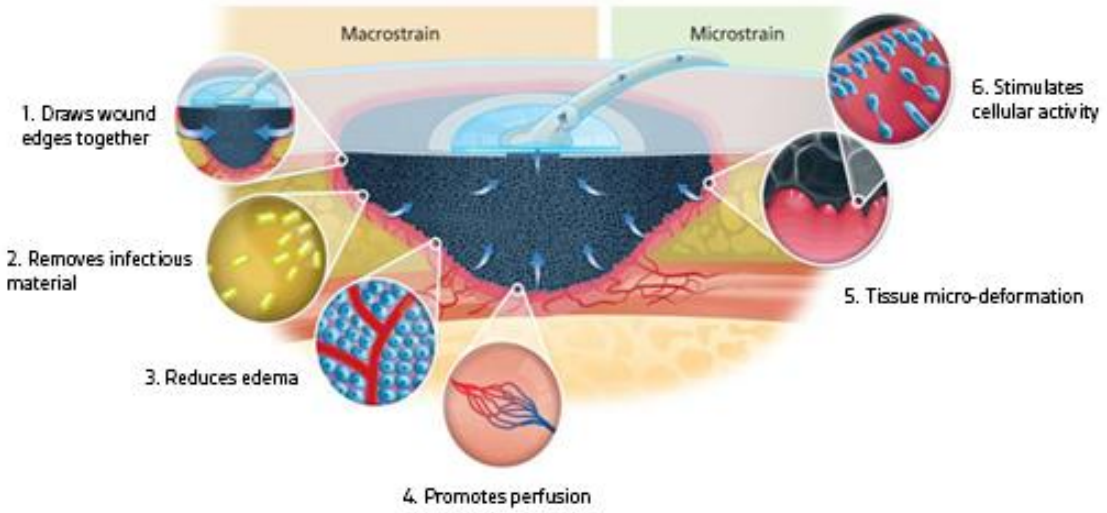
Typical suction pressure: 125mmHg continuous

Change dressing 2-3x per week

NPWT

Indications

- Wounds with moderate to copious drainage
- Acute/surgical wounds
- Chronic wounds
- Full thickness burns
- Diabetic/Neuropathic
- Venous/Arterial wounds
- Pressure injuries



NPWT Precautions and Contraindications

Precautions*:*

Unexplored fistula

Bleeding disorder or anticoagulation therapy

Contraindications:

Malignancy

Untreated osteomyelitis

Exposed vessels, organs or nerves

Wounds with >30% devitalized tissue

NPWT Alarms and Error Messages

Leak Detected

- Look/listen for a gap in the drape or between the drape & skin
- If you detect a leak, use extra drape to reinforce

Blockage Detected

- Check dressing to make sure foam is not “puffed up” - if puffy, replace dressing
- Check that clamps are open & patient is not lying on tubing
- Check line for coagulated blood

NPWT Alarms and Error Messages

Low Pressure Alert

- Check tubing as with Blockage Alarm
- Lower therapy unit to below wound level

If none of these work, replace the dressing!

More NPWT Alarms and Error Messages

Canister Full Alarm

- Replace canister

Battery Critical Alarm

- Approximately 2 hours of battery life remains
- Plug in unit, check that cords are properly connected

NPWT Special Situations

White foam – Set NPWT to 150mmHg

- Tunnels, tracts, areas unable to visualize
- Can be used over exposed organs
  - However this is an off-label use

Impregnated gauze to protect exposed tendons, bone, muscles

- Protect staples & sutures in the periwound

NPWT Special Situations

Can be used with irrigation instillation setting, normal saline solution (NSS), Dakin's or acetic acid

- 3.5 hours normal suction, 10 minutes instillation
- Can also be used in "Dressing Soak" mode

If used following split thickness skin graft (STSG)

- Usually placed by surgical team
- Not to be removed x5 days

NPWT Special Situations

Incisional dressings

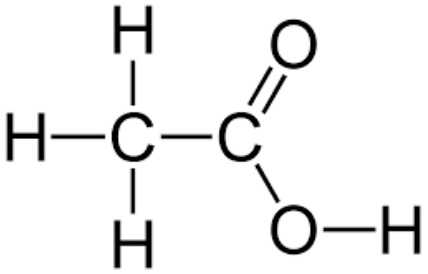
Comfort measures

NPWT Instillation

Dakin's Solution (Sodium hypochlorite)

- Commonly known as *bleach*
  - Diluted to 0.05% or 0.025%
- Produces potent antibacterial effects in tissues
- Uses:
  - *Enterococcus Streptococcus mitis*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Escherichia coli*, *Klebsiella pneumonia*, *Enterobacter cloacae*, *Serratia marcescens*, *Proteus mirabilis,* and *Pseudomonas aeruginosa*
  - *MRSA, VRE, PG*
- Can be corrosive to healthy tissue (Nagoba 2013)
  - Should be D/C'd when wounds exhibit increased granulation tissue or after 5-7 days of instillation

NPWT Instillation



Acetic Acid

Mixture of vinegar and water

Lowers the pH of the wound bed (remember Manuka Honey?)

- Accelerates wound healing

Used in 0.5% concentration for antibacterial effects but can be higher

Uses

- Burns and wounds with pseudomonas aeruginosa

Combining Treatments

Hanikoda Method

- *The Hanikoda Method: 3-layered Negative Pressure Wound Therapy in Wound Bed Preparation by Chik, et al, 2016*
  - Layer 1: Enzymatic debriding agent on wound base
  - Layer 2: Paraffin gauze or adaptic
  - Layer 3: NPWT running as usual
- Rationale: combination of dressings were chosen to help facilitate debridement while simultaneously reducing the bacterial load and size of the wound (Chik 2017)

NPWT Billing

Only one daily wound treatment charge can be billed per day

- **97605** - Less than or equal to 50 sq cm
- **97606** - Greater than 50 sq cm

More than one charge cannot be billed per day regardless of number of wounds, number of devices, etc.

- *Charge is based solely on **total** wound size.*

If your treatment consists solely of activities related to dressing troubleshooting/bolstering, or education related to home vac therapy, “Ther Act” should be billed (as long as it is greater than 8 minutes)

Non selective debridement charges and NPWT charges cannot be billed on the same date for the same anatomical site. (Selective debridement charges and NPWT charges may be billed on the same day for the same anatomical site)

Electrical Stimulation (ES)

Indications:

Stage III or IV pressure injuries

Neuropathic foot ulcers

Ischemic ulcers

Venous leg ulcers

Rationale for ES

Increase cell migration and proliferation

Increase cutaneous oxygen transport and blood flow

Antibacterial effects

Faster re-epithelialization

Enhanced scar tensile strength

Procedural Considerations for ES

Use a HVPC (monophasic) waveform

- Pulse rate most commonly used in wound healing is 50-120pps
- Amplitude 75-150 V (sensory paresthesia, submotor)
- Treatment duration: 45-60 min, 5-7 days/week

Place treatment electrode directly over wound (or straddle wound with electrodes)

Polarity of treatment electrode varies with goals of treatment

Polarities and Effects for ES

Positively polarity

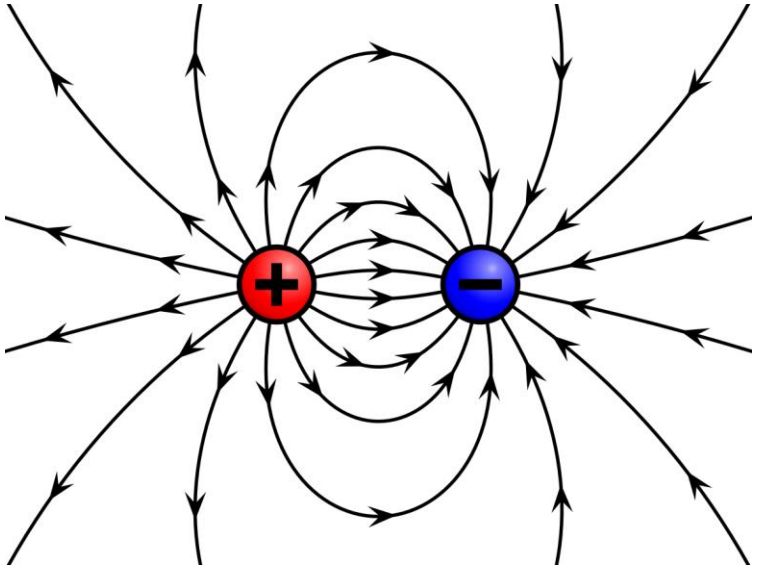
- Increases blood flow
- Decreases edema
- Enhances debridement
- Thrombolysis

Negative polarity

- Collagen formation
- Fibroblast
- Tendon repair

Alternating

- Wound contraction (Myofibroblasts)



Contraindications for ES

Electronic pacing implants

Directly over heart or carotid sinus

Basal or squamous cell cancer, melanoma

Untreated osteomyelitis

Acute infection

Superficial metal or ion residues

Caution with desiccation during treatment

Traditional Ultrasound (US)

Rationale

- Improves cell permeability
- Fragmentation of bacteria
- Increased collagen synthesis
- Stimulation of healing

Photo courtesy of K Wientjes, DPT

Procedural Considerations for US

Apply ultrasound gel to surrounding intact periwound

Parameters

- Pulsed, 20% duty cycle
- Intensity: 0.3 - 0.5 W/cm^2
- Frequency :1 MHz or 3 MHz (depending on wound depth)
- Duration- 1 min/cm^2

Traditional Ultrasound (US)

Indications

- Venous leg ulcers
- Pressure ulcers
- Recalcitrant wounds
- Periwound induration

Contraindications

- Pregnant uterus
- Malignancy
- Acute infection or inflammatory process
- Presence of hypergranulation

Traditional US

Photos courtesy of K Wientjes. DPT

Intermittent Pneumatic Compression

Indications for use

- Venous insufficiency
- LE edema
- Lymphedema

Methods of healing

- Reduced edema
- Enhanced fibrinolytic activity
- Improved healing when compared to compression stockings alone

Compression Therapy

Gradient sequential

- Leg sleeve is divided into chambers, either 3, 5 or 10 chambers, with peak pressures at the ankle
- The sleeve first inflates at ankle, followed 2.5 seconds later by calf chambers, and 3 seconds later, the thigh chambers
- Total inflation time is 5 seconds, followed by complete deflation
- Cycle repeats every 7-8 seconds for the treatment time

Considerations for Compression

Assess pulses and BP

- ABI 0.8-1.0, use high compression
- ABI 0.5-0.8, use low compression
- ABI 0.5 or below, compression is contraindicated
  - Refer to vascular

Keep compression at least 20 mmHg below diastolic pressure

- *If arterial insufficient, keep compression below 40 mmHg

Position with LEs elevated

Place limb in bag and then into compression sleeve (limb may weep during treatment)

- Make sure patient uses the bathroom prior to beginning treatment

Considerations for Compression

Treat for 30-60 minutes per session

- 1-2 times per day

Apply semi-rigid or short-stretch bandage immediately after pumping

- Crepe elastic wraps, Unna boot
- Try not to allow the limb to fall into a dependent position while/before wrapping
- Long-stretch bandage if patient is fairly inactive
- Setopress, surepress

Compression Therapy

Contraindications for Compression

Acute:

- DVT (within 6 months)
- Infection or untreated infection
- Fracture
- Active CHF
- Renal Failure

Severe ischemic disease

Severe lymphedema

Venous or Lymphedema?

	Lymphedema	Venostasis
Edema consistency	Soft, pitting progressing to spongey and firm	Brawny, pitting
Edema distribution	Diffuse, more distal than proximal	Ankles and legs, feet usually spared
Relief with elevation	Mild to moderate, over several days	Almost complete in several hours to one day
Bilaterality	As often as not	Occasional
Severity of pain	None, or “heaviness”	Aching
Skin	Eventually thickened, ulceration rare	Atrophic pigmentation, possible ulcer

Compression Wraps

Level of support	Examples	Recommendations for use
Light (8-14 mmHg)	Fashion hosiery	Edema prevention for persons engaged in activity/work that requires long sitting/standing with minimal activity
Anti-embolism stockings (16-18 mmHg)	Jobst, Sigvaris, TED stockings, Tubigrip	DVT prophylaxis
Low compression (18-24 mmHg)	Elastic wraps (ACE, Unna boot)	Dependent edema
Low to moderate compression (25-35 mmHg)	Custom fit, Multilayer wraps (4 layer bandage)	Venous insufficiency
Moderate compression (30-40 mmHg)	Profore, custom stocking	Ulcers failing to heal
High compression (40-50 mmHg)	Custom	Edema 2/2 lymphedema

Case Study #1

63 y/o F admitted to the hospital with chronic right posterior calf wound with increased discharge from wound, +odor, increased edema, +PG

Lives alone, retired, former smoker

- PMH
  - RA
  - Anxiety
  - Morbid obesity
  - Hypothyroidism
  - H/o DVT
  - Cellulitis
  - Hashimoto's

Case Study #1

PSH

- Debridement of wound – multiple from 1/28-4/18 at OSH

Consulted for wound care from PRS

- Not a surgery candidate, h/o failed STSG x2

Other consults include ID, rheumatology, dermatology

Labs

- Hgb 11.0 (L)
- WBC 11.6 (H)
- Neutrophils 89 (H)

Wound

- 19.5 x 13.2 x 2.1 cm with green malodorous drainage

Case Study #1

Treated with NPWT with Dakin's instillation

- 0.0125% on a cycle of 26mL soak for 10 minutes every 3.5 hours
- Mepitel on wound base below NPWT 2/2 increased pain with dressing changes
- Utilized CleanseChoice dressing from KCI

Case Study #1

EVALUATION: 11/15/19

FIRST DRESSING CHANGE: 11/18/19

Case Study #1

10/01/2020

Progression of Wounds

Progression of Wounds

Exceptional Circumstances

Exceptional Circumstances

References

Anemaet, W. (2020). *Wound Care: Dressing, Positioning, Pressure Relief, & Risk Reduction*. Lecture.

Cardinal Health *Negative Pressure Wound Therapy.* Retrieved on February 20, 2020 from https://www.cardinalhealth.com/content/dam/corp/web/documents/Manual/cardinal-health-npwt-reimbursement-fact-sheet.pdf

Chik, I, et al. (2016). The Hanikoda Method: 3 Layered Negative Pressure Wound Therapy in Wound Bed Preparation. *Wounds 2016;28(10):360-368*

Commonwealth of Pennsylvania. (2020). 49 Pa. Code Chapter 40. State Board of Physical Therapy. Retrieved September 29, 2020, from http://www.pacodeandbulletin.gov/

Healthline. *How, When, and Why Honey Is Used for Wound Care.* Retrieved February 20, 2020 from https://www.healthline.com/health/honey-on-wounds

Keyes, M. *Dakin's Solution (Sodium Hypochlorite).* October 1, 2019. Retrieved February 20, 2020 from https://www.ncbi.nlm.nih.gov/books/NBK507916/

LaRaus, S. (2020). *Wound Care Basic Training Part 2: Treatment*. Lecture.

Nagoba, B, et al. (2013). Acetic acid treatment of pseudomonal wound infections – A review. *Journal of Infection and Public Health*, vol 6:6. https://www.sciencedirect.com/science/article/pii/S1876034113000956

Pierson, F., & Fairchild, S. L. (2008). Chapter 11: Basic wound care and specialized interventions. In *Principles & techniques of patient care* (pp. 297-328). St. Louis, MO: Saunders Elsevier.

Sussman, C, Bates-Jensen, B. (2007). *Wound Care*. Baltimore, MD, USA: Lippincott, Williams and Wilkins.

Sussman, C., & Bates-Jensen, B. M. (2007). Chapter 11: Management of the wound environment with dressings and topic agents. In *Wound care: A collaborative practice manual for health professionals* (pp. 250-268). Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins.

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