Interventions for Wound Healing

Case Studies

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Interventions for Wound Healing

Objectives

- Integrate the knowledge gained from previous sessions today into real patient cases from our Wound Healing and Hyperbaric Center
- Chronic Venous Disease Management
- Negative Pressure Wound Therapy
- Total Contact Casting
- No financial, professional, personal disclosures
  - If branding is mentioned, that is due to the materials available at the time of the patient's wound healing experience.

Case 1: Edema Control for wound healing

Venous Ulcerations

Overview

Types of Edema

- Lymphedema
  - Protein Rich
- Venous Edema
  - High water content
- Combined
  - Mechanical insufficiency
  - Dynamic insufficiency
  - Water and protein rich edema

Ulcerations

- Common complication of chronic venous insufficiency and venous edema
- Result of venous hypertension
- Do not occur spontaneously nor is CVI sole factor.
  - Most begin with a trigger- Examples: cellulitis, injury/ trauma, contact dermatitis, rapid onset of leg edema, burns, dry skin, insect bites

Characteristics

- VLU usually occurs on medial side of lower leg between the ankle and knee.
- All ADLs are affected with **pain** being a continuous problem.
- In the US, comprise over 50% of all LE ulcers.

Venous Ulcerations

Treatments

Necrotic tissue removal

- Surgical/sharp debridement
- Enzymatic-collagenase coapplied with antibiotics
- Autolytic
- Mechanical- pulsatile lavage or low frequency ultrasound

Bacterial Control

- Risk of tissue infection = bacterial dose x virulence/host resistance
- Considering individuals immune response, tissue hypoxia and circulation (DM, PVD, Ly, CVI)
- Culturing/biopsy and antibiotic treatments
  - 1. Staphylococcus aureus
  - 2. Streptococcus pyogenes
- Betadine solution, topical antiseptic, silver technologies

Exudate management

1. Absorptive dressing
   - Foams – vertical wicking semi-permeable
   - Hydrofibers, Alginates,
   - Super-absorbents
2. Negative Pressure dressings
3. THE MOST IMPORTANT FACTOR in reducing exudate levels is appropriate sustained compression therapy, not the dressing!

Zuther 2018

Venous Ulcerations

Compression Bandaging

Mechanism

- Assists in venous return from the lower limb by exerting external pressure
- Creates higher pressure near the ankle and lower pressure at the calf; pressure gradient forces blood to move back up the leg toward the heart.

Multi-component systems

- VLUs heal faster when compression is used.
- More effective than single layer systems or inelastic compression
- Provide compression when the individual is active AND then at rest
- Key feature is exudate absorption
- Not recommended for ankle circumferences <18 cm

Case 1- Venous Leg Ulcer

History

- 52 y/o female presents with venous leg ulcer of the left medial lower leg. Ulcer started as a blister. This is the second time the area had ulcerated in 1 year. Her PCP is treating her for cellulitis using oral antibiotics and referred to wound care.

- Medical history includes obesity BMI 46, leg edema, recurrent leg cellulitis, superficial vein thrombosis, no DVT, tobacco dependence since she was 11 y/o, chronic fatigue, depression and anxiety, neurogenic bladder, opioid dependence.

- Family history significant for lower extremity edema in her mother and other close relatives.
- Social history significant for profession as a nurse working long hours on her feet, smoker, history of pregnancy, **NO insurance**

Case 1- Venous Leg Ulcer

HPI details

- Location- Left medial lower calf
- Initial etiology- gradually appeared vs trauma
- Updated etiology- venous insufficiency
- Exacerbated by- long periods of standing, leg swelling
- Improved by- elevating lower extremity, analgesics (opioids), compression stockings, antibiotics, dressing changes
- Associated symptoms- persistent drainage, leg edema, erythema, warmth, pain
- Pain quality- 8/10 on pain scale, constant burning

Case 1- Venous Leg Ulcer

Review of systems

- Constitutional: fatigue (chronic), gradual weight gain, negative fever-like symptoms
- Cardiac: no chest pain or pressure
- Pulmonary: no shortness of breath or orthopnea
- Abdominal: obesity, feeling of fullness
- Musculoskeletal: gaiter disturbance, impaired calf muscle action
- Neurological: hyperalgesia from chronic opioid use
- Vascular/Hematology: edema (chronic leg edema), no blood clots, no anemia, no known diagnosed arterial insufficiency although suspected since she smokes
- Skin: discoloration of lower legs, skin ulcer left leg
- Psychiatric: depression, anxiety
- Endocrine: no diabetes, no thyroid issues
- Lymphatics: no palpable masses or new swelling

Case 1- Venous Leg Ulcer

No diuretic

No anticoagulation

Medication
Citalopram Hydrobromide [Citalopram HBr]
Ibuprofen
Mirabegron [Myrbetriq]
Omeprazole Magnesium [Prilosec Otc]
oxybutynin chloride 5 mg tablet
albuterol sulfate 90 mcg/actuation aerosol inhaler
alprazolam 0.25 mg tablet
benzonatate 100 mg capsule
doxylamine-PE-DM-acetaminophen 6.25 mg-5 mg-10 mg-325 mg capsule
gabapentin 300 mg capsule
oxycodone-acetaminophen 5 mg-325 mg tablet
Lactobacillus Rhamnosus R0011 [Probiotic Digestive Care]
levoFLOXacin

Allergy/AdvReac
methylprednisolone
TAPE

Case 1- Venous Leg Ulcer

Exam

- **Constitutional:** positive for ulcerative pain, positive for obese
  Psychiatric: anxious, cooperative, good insight
  Neurological: positive for alert and oriented, normal monofilament testing left foot
  Cardiac: positive for regular rate and rhythm
  Respiratory: positive for clear to auscultation, positive for breathing unlabored
  Upper extremities: positive for edema (nonpitting edema of UEs including hands), positive for other (large circumference of arms and hands)
  Lower extremities: edema (pitting edema BLEs with hemosiderin staining, fibrosis of skin; does not include the feet, and there is a definitive demarcate of edema and adipose tissue at the level of the ankles which appears as a panniculus), positive for tenderness, erythema, warmth, positive for wound, (No cord-like varicosities of the left lower extremity)
- Vascular: Dorsalis Pedis and Posterior tibial pulses NOT palpable, DP and PT ARE doppler audible, left ABI 0.91.

Case 1- Venous Leg Ulcer

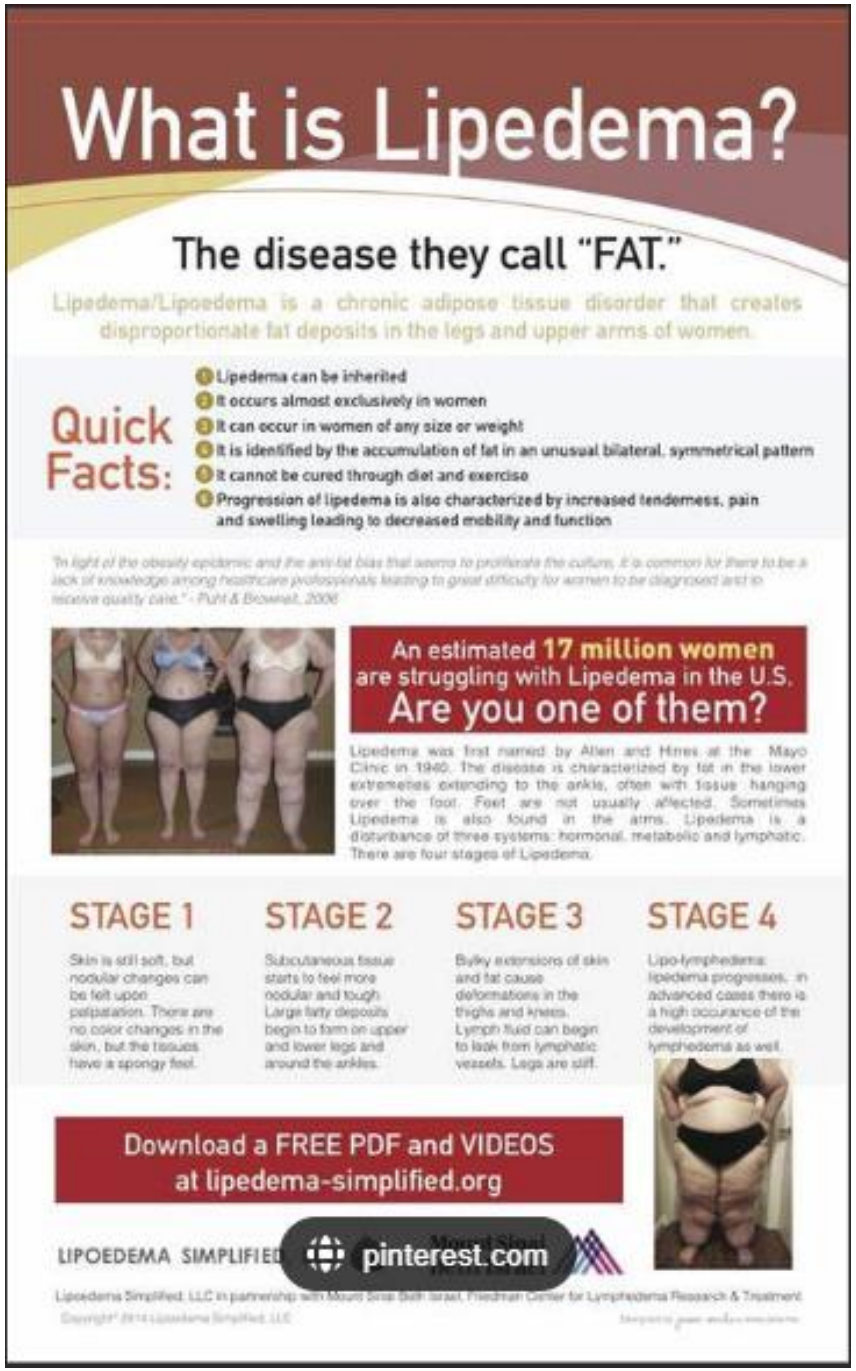
Wound Exam and Procedure

- **Type of wound::** Venous Stasis (Left, Medial Lower Leg)
  Wound severity: Fat Layer Exposed
- **Wound contents:** Positive: Necrotic tissue, Slough, Fibrin, Edges (irregular, undefined)
  Negative: Granulation, Tunneling (direction, mm), Undermining (direction, mm)
  Preprocedure measurements: LxWxD cm: 2.5x4.5x0.6
  Debridement recommended:: Yes
  Informed consent obtained:: Yes
  Prep used:: Cleansed, usual fashion, 4% topical lidocaine
  Contents debrided:: Fibrin, Slough, Exudate, Non-viable skin, Non-viable SQ tissue
  Debridement depth: Sub Q
  Instruments used:: Curette
  Bleeding: Minimal
  Bleeding controlled with:: Time
  Post-measurement (cm) LxWxD:: 2.5x4.5x0.6
  Procedure tolerated well?: No

Case 1- Venous Leg Ulcer

- 12/04/2023
  - 2.5 x 4.5 x 0.6 CM

Lipedema


What is Lipedema?
The disease they call "FAT."
Lipedema/Lipoedema is a chronic adipose tissue disorder that creates disproportionate fat deposits in the legs and upper arms of women.
Quick Facts:
1 Lipedema can be inherited
2 It occurs almost exclusively in women
3 It can occur in women of any size or weight
4 It is identified by the accumulation of fat in an unusual bilateral, symmetrical pattern
5 It cannot be cured through diet and exercise
6 Progression of lipedema is also characterized by increased tenderness, pain and swelling leading to decreased mobility and function
"In light of the obesity epidemic and the anti-fat bias that seems to proliferate the culture, it is common for there to be a lack of knowledge among healthcare professionals leading to great difficulty for women to be diagnosed and to receive quality care." - Puhl & Brownell, 2006
An estimated 17 million women are struggling with Lipedema in the U.S. Are you one of them?
Lipedema was first named by Allen and Hines at the Mayo Clinic in 1940. The disease is characterized by fat in the lower extremities extending to the ankle, often with tissue hanging over the foot. Feet are not usually affected. Sometimes Lipedema is also found in the arms. Lipedema is a disturbance of three systems: hormonal, metabolic and lymphatic. There are four stages of Lipedema.
STAGE 1
Skin is still soft, but nodular changes can be felt upon palpation. There are no color changes in the skin, but the tissues have a spongy feel.
STAGE 2
Subcutaneous tissue starts to feel more nodular and tough. Large fatty deposits begin to form on upper and lower legs and around the ankles.
STAGE 3
Bulky extensions of skin and fat cause deformations in the thighs and knees. Lymph fluid can begin to leak from lymphatic vessels. Legs are stiff.
STAGE 4
Lipo-lymphedema: lipedema progresses, in advanced cases there is a high occurance of the development of lymphedema as well.
Download a FREE PDF and VIDEOS at lipedema-simplified.org
LIPOEDEMA SIMPLIFIED
pinterest.com
Lipoedema Simplified, LLC in partnership with Mount Sinai Beth Israel, Friedman Center for Lymphedema Research & Treatment

Lipedema

Case 1- Venous Leg Ulcer

Assessment and Plan
(1) Chronic venous insufficiency of lower extremity
(2) Venous stasis ulcer or Non-pressure ulcer with fat layer exposed
(3) Lipedema
(4) Pain of left calf

Case 1- Venous Leg Ulcer

Assessment and Plan

- Patient's clinical appearance of the lower extremities and upper extremities in combination with her family history suggests diagnosis of lipedema at an advanced stage. This contributes to secondary venous insufficiency and presence of leg ulceration. She has a lymphedema therapist where she works that will be doing decongestive therapy and leg wraps on her legs. She does not have insurance. Recommend comprehensive local wound care with sharp debridement. Ulcer is not amenable to tissue culture d/t pt's pain.
- Due to the severity of calf pain, advise urgent venous US with DVT eval to rule out presence of DVT prior to any further leg treatments. This was completed after her appointment and result was negative, patient notified. Orders given to stop Bactrim antibiotic. Start empiric antibiotic levofloxacin 500mg PO daily x10 days, will monitor for improvement of pain

- Dressing: Stop Aquacel Ag (d/t cost); start Triad paste which was provided today
- Dressing change frequency: Every other day
- Wound edema control: Other (Tubigrip placed today left leg for dressing securement)
- Follow up:: 1 week

Treatments Towards Wound Healing

- Skin Care
  - Hibiclens (4% chlorhexidine gluconate) for skin and wound
  - Affordable, Accessible, Gentle
- Dressings
  - Triad Hydrophilic Paste
  - MediHoney gel or paste
- Edema Management
  - For active wound treatment:

  Coflex 2-layer wrap lite 20-30mmhg calamine infused
  - For maintenance:

  Velcro compression garments ordered online at **lymphedemaproducts.com**

Wound Care Education Institute

Multi-layer compression wraps	• Provides compression at modified and therapeutic levels • Provides compression when individual is active and at rest • Absorb exudate • 4-layer is the gold standard	• Are bulky and costly • Are single use only • Are not recommended for ankles < 18 cm • Require extra layer for ankles > 26 cm • Cannot be worn during bathing
Intermittent pneumatic compression	• Are easy to apply and use • Can be used when standard compression therapy has failed, or patient is unable to tolerate other types of compression • Uses predetermined levels of compression	• Cannot be used when infection, heart failure, and severe arterial disease is present • Must sit or lie down for a few hours each day for treatment • Are expensive
Compression stockings	• Are reusable and washable • Can be used in both sedentary and active individuals • Are available in different levels of compression and different lengths	• Can be difficult to apply • Has a decrease in elasticity over time • Are expensive • Are difficult to use with open wound • Can be hard to find bariatric sizes

Wound Care Education Institute

Compression Bandaging Systems

Pressures	Support	Examples	ABI
18-24 mmHg	Low	ACE™ wrap, Coban™	0.5
25-35 mmHg	Low to moderate	Profore® Lite, SurePress®	0.5-0.8
30-40 mmHg	Moderate	Duke Boot, Comprilan®, Setopress®, Profore®	> 0.8
40-50 mmHg	High	Custom fit stockings, JOBST®, sequential pumps	> 0.8

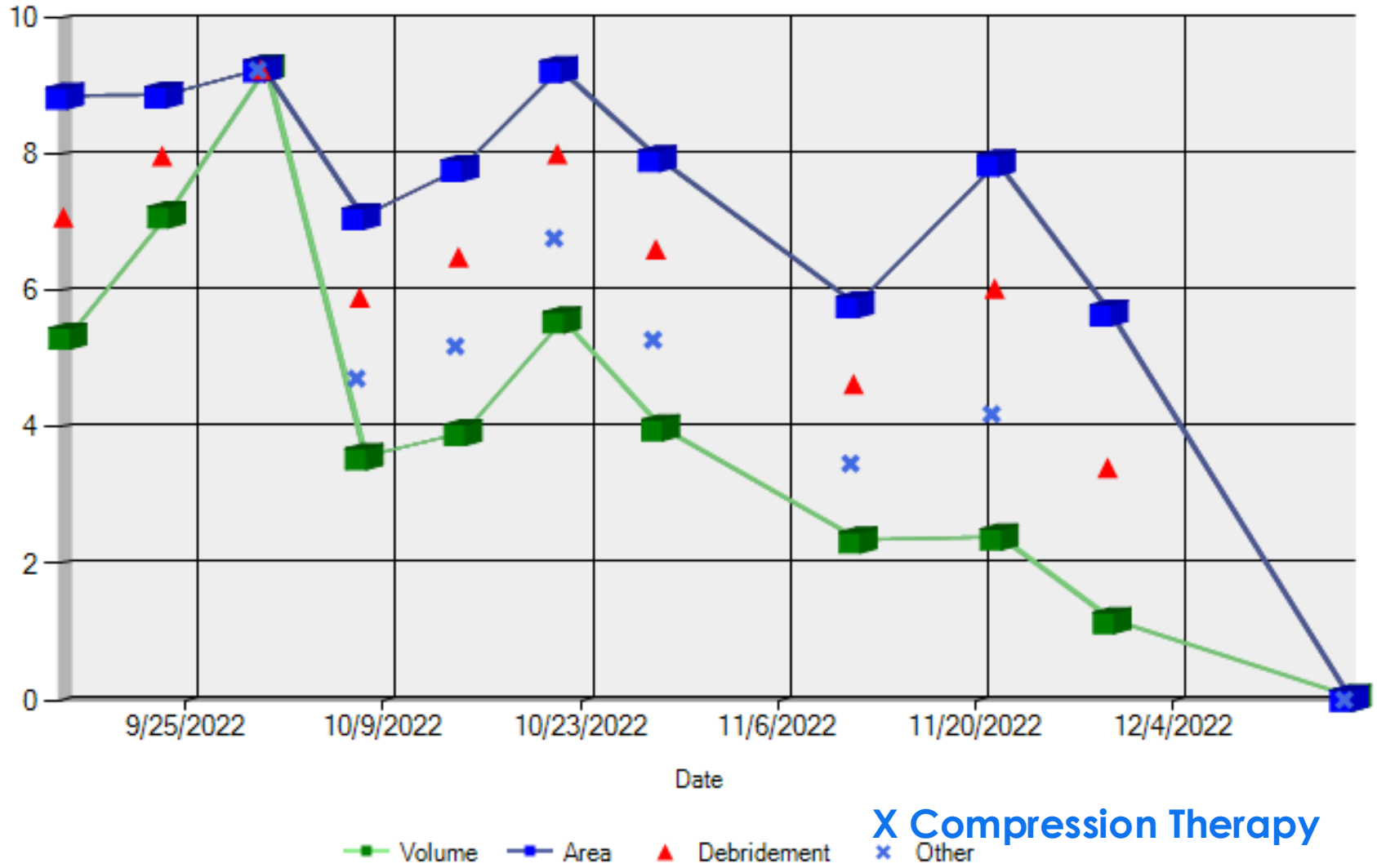
ABI Interpretations

ABI	Interpretation	Management
≥ 1.0	Normal	Blood flow adequate for healing
≤ 0.9	Lower extremity arterial disease (LEAD)	Trial of conservative wound care, pressure relief, nutrition, wound management principles
≤ 0.6-0.8	Borderline, moderate occlusion	Vascular referral, frequent monitoring of wound
≤ 0.5	Severe ischemia	Vascular referral, maintain dry stable eschar
< 0.4	Limb threatened	Urgent vascular referral

Case 1- Venous Leg Ulcer

- Counseling over the course of treatments
  - Smoking cessation counseling.
  - Diet decrease fluid intake, low-sodium/heart healthy diet, high protein consumption
  - Exercise
  - Lymphedema management from physical therapy
  - Lymphedema vs Venous edema vs Lipedema

Area / Volume Progress



X Compression Therapy

Progression of wound healing

- 5 weeks

- 9 weeks

Progression of wound healing

- Time to heal
  - 13 weeks
    - 12/16/2022
  - Average is 6 months with treatment by healthcare professional

Case 1- Venous Leg Ulcer

Wound recurrence at 1 year.

- Major change in patient's plan of care and treatment was her ability to acquire *insurance*.
  - Able to proceed with necessary imaging to diagnose underlying reflux disease of the venous system and treat accordingly.
  - More frequent wound care visits and ability to prescribe other dressings.
  - Short term disability/leave of absence from work for wound healing.
  - Reduction in smoking but has not quit.
  - Weight loss through dietary limitations, apx 40 pounds.
  - Ongoing use of knee-high compression hose, lifelong.

Wound recurrence

12/04/2023

- 4 X 6 X 0.3 CM

Case 1- Venous Leg Ulcer

BLE Venous US w/ perforators:

Positive for reflux in the right and left GSV

Negative for DVT bilaterally

Case 1- Venous Leg Ulcer

BLE Arterial US:

Decreased LEFT ABI indicating moderate to severe peripheral vascular disease.

No arterial occlusion noted.

Case 1- Venous Leg Ulcer

Cardiology Referral

Left lower extremity EVLT of the GSV and medial ankle perforator (Dr. Seshadri)

LLE Venous US Post EVLT

Post therapeutic thrombus throughout the GSV

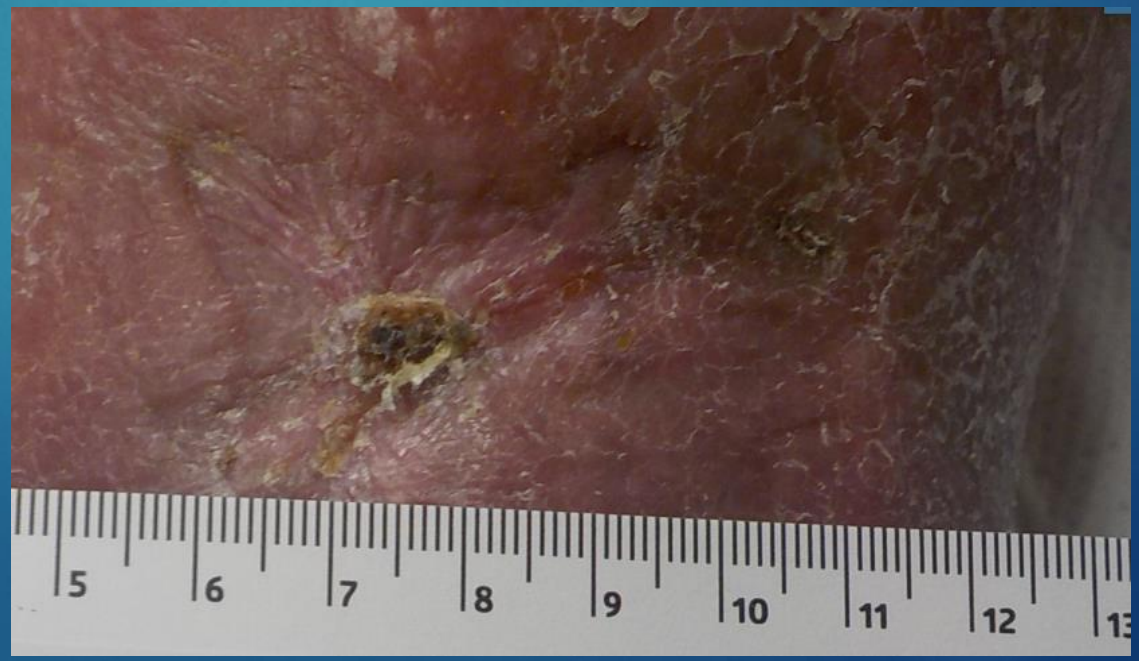
Progression of wound healing

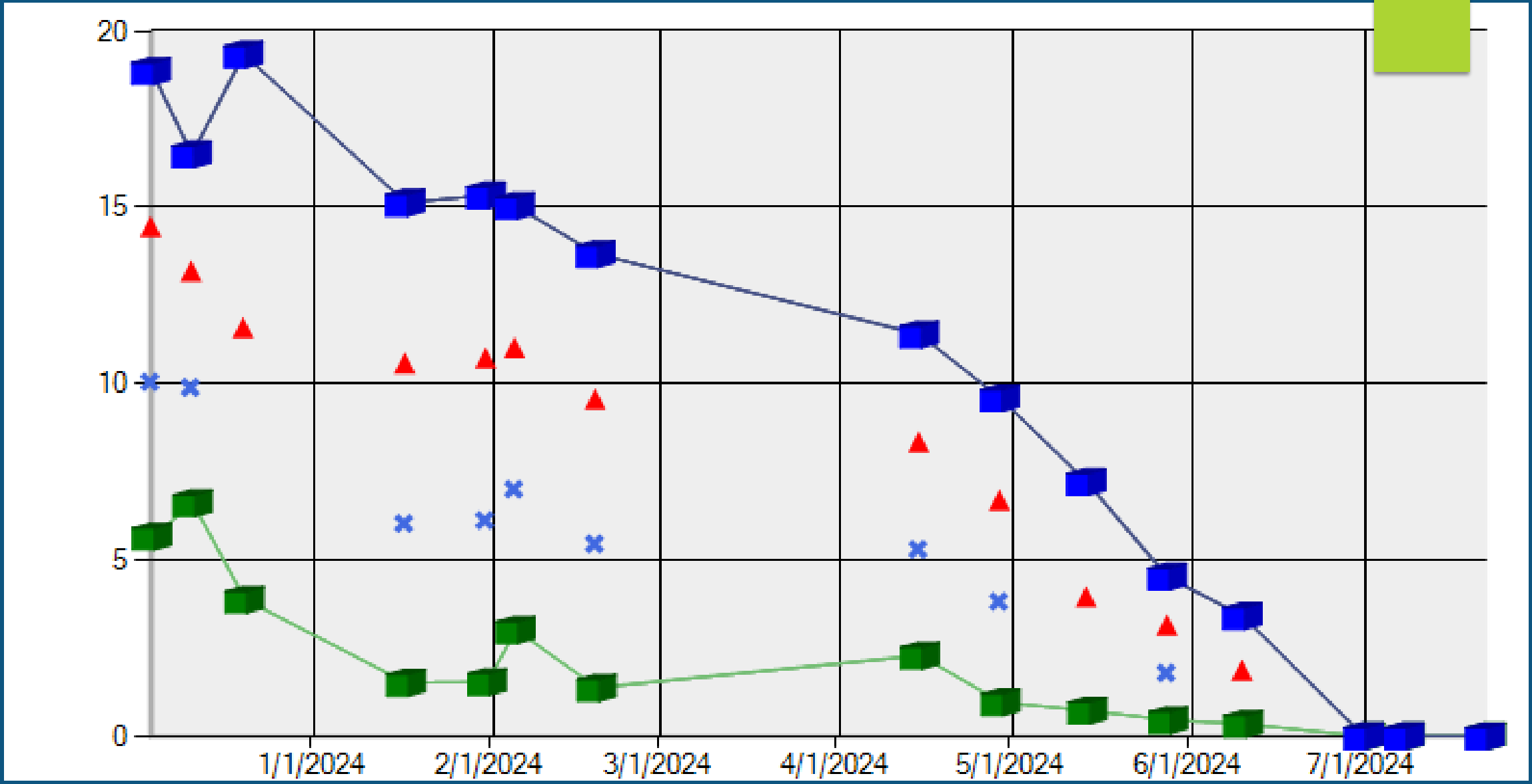
9 weeks and 27 weeks

- Comprehensive Wound Care

Time to heal 33 weeks

- Post EVLT
- Average is 6 months with treatment by healthcare professional

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Case 2: Negative Pressure Wound Therapy for Wound Healing

Negative Pressure Wound Therapy Devices (Powered)

Cleveland Clinic

Purpose

• Improves cellular migration and promotes granulation tissue formation

• Available for use in clinical and home settings

Indication

• The application of suction (negative pressure) is to promote wound healing

• Removal of excess exudates, infectious material and tissue debris from chronic, acute, traumatic, subacute, and dehisced wounds such as

Contraindications

•In cases where there is malignancy in the wound (except for quality of life reason for terminal patients), untreated osteomyelitis, non-enteric and unexplored fistulas, necrotic tissue with eschar present, exposed vasculature/ nerves/ anastomatic site/ organs, malnourished patients or for pediatric use.

Negative Pressure Wound Therapy Devices (Powered)

Cleveland Clinic

Benefits

- Improved healing
- Reduced swelling (edema)
- Less inflammation
- Better blood flow, which brings oxygen to the wound more easily
- Fewer dressing (like foam or gauze) changes (every 48 to 72 hours)
- Device portability
- Shorter hospital stay

Risks

- Bleeding
- Pain
- Infection
- Foam sticking to the wound
- Allergic reaction to materials in contact with the wound
- Damage to the wound
- Device failure from a low battery, blocked tube or incorrect setup

Case 2- Negative Pressure Wound Therapy

History

- 77 y/o female presents with large nonhealing necrotic wound in the left lower leg. The patient sustained injury one month prior in the left lower leg and developed very large hematoma with compartment syndrome. Evacuation of the hematoma was performed along with fasciotomy as well as **primary closure** of the very complex wound.
- Subsequently, the patient developed **necrosis of the flap** and was referred to our clinic for further evaluation and treatment.
- Required extensive washout and surgical debridement including skin, subcutaneous tissue and muscle. Left open for **wound healing by secondary intention**.
- Follow up in the wound care clinic for **comprehensive treatment** including regular debridement and negative pressure wound therapy.

Case 2- Negative Pressure Wound Therapy

Case 2- Negative Pressure Wound Therapy

Opportunities

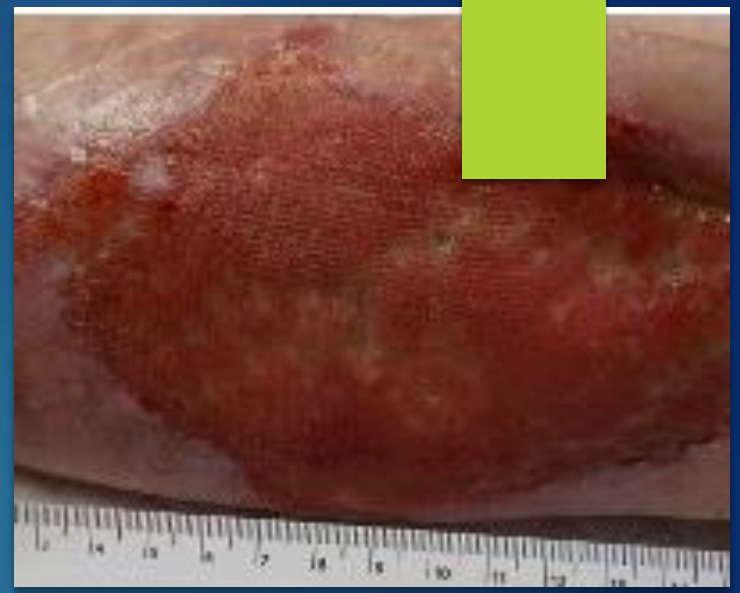
- Negative Pressure Wound Therapy (NPWT)
  - Utilized for 2 months
  - 1st month of therapy without any other wound applications
- Additional treatments
  - PMR
    - Tapered to low dose prednisone
  - Acute on chronic lower extremity edema compromising wound healing
    - Started 2-layer leg wraps for edema control while using NPWT
  - Non-weight bearing left leg
    - Leg elevation
  - Nutrition, h/o chronic nausea with significant supplement use
    - Encouraged small frequent meals to increase caloric intake, separate supplements

Case 2- Negative Pressure Wound Therapy

- Additional treatments
  - Candidate for a skin graft to minimize scar tissue formation and definitive wound closure.
    - Patient declined grafting to avoid additional surgical procedure and to avoid having a new wound from the donor graft site that would require treatment.
  - Advanced therapy- Engineered skin as amniotic tissue allograft
    - Initiated after 1st month of NPWT.
    - Utilized in combination with NPWT.
    - Utilized through almost complete wound closure.

Progression of wound healing

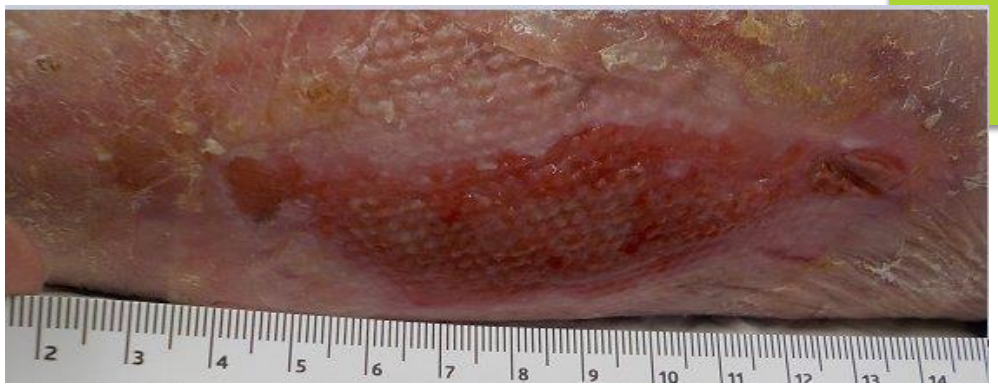
- 12/21/22
  - Started NPWT
  - Comprehensive Wound Care
- 1/25/23
  - Started Amniotic tissue in addition to NPWT
- 2/1/24
  - Stop NPWT
- 2/14/23
  - Started compression therapy

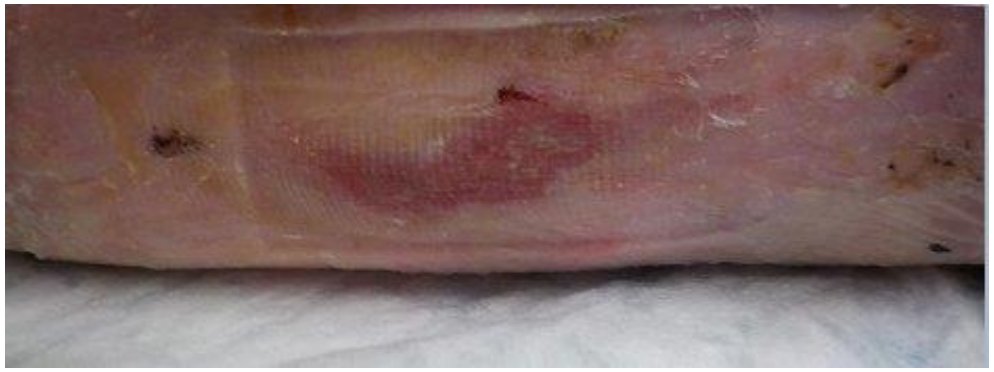


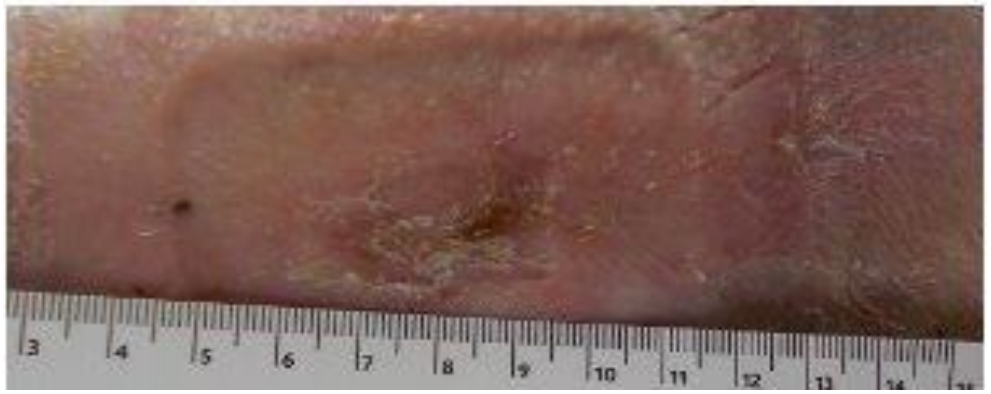
Progression of wound healing

Time to heal

- 8 months







Case 3: Casting for Wound Healing

Total Contact Cast

Total Contact Casting
WoundCareCenters.org
WoundEducators.com

What is TCC?

- A special casting technique designed to heal diabetic foot ulcers by relieving pressure on the prominent areas of the foot that are prone to skin breakdown and ulceration.
- Is composed of fiberglass or plaster.

Why use TCC?

- It is applied so that the patient can remain ambulatory for the duration of the casting.

How does it work?

- By distributing weight more evenly over the entire surface of the foot, rather than on a few select areas
- TCC can effectively reduce pressure on the most vulnerable areas of the foot where ulceration is most likely to occur

Case 3- Casting for Wound Healing

Opportunities

History

- 67-year-old male patient with chronic/nonhealing surgical wound of the left foot associated with uncontrolled diabetes mellitus type II. History of extensive debridement and left foot trans-metatarsal amputation 5 months prior.
- Using **dry gauze** over the wound and Ace wrap. Wears **tennis shoes**.
- Unable to get into custom molded inserts due to the wounds remaining open.
- **Knee scooter** use causing **Right** foot callus formation from excessive pressure.

Case 3- Casting for Wound Healing

- Initial wound presentation

- 2 weeks
  - Comprehensive Wound Care
  - Prior to TCC application

Case 3- Casting for Wound Healing

THINK! TCC Precautions

- INFECTION
  - Overt vs Covert signs, pressure can mimic infection
- CIRCULATION
  - ABI 0.8 - 1.3
- BALANCE
  - Use of cane, crutches, walker
- RELIABILITY
  - Ability for close follow up
  - Reporting symptoms

Case 3- Casting for Wound Healing

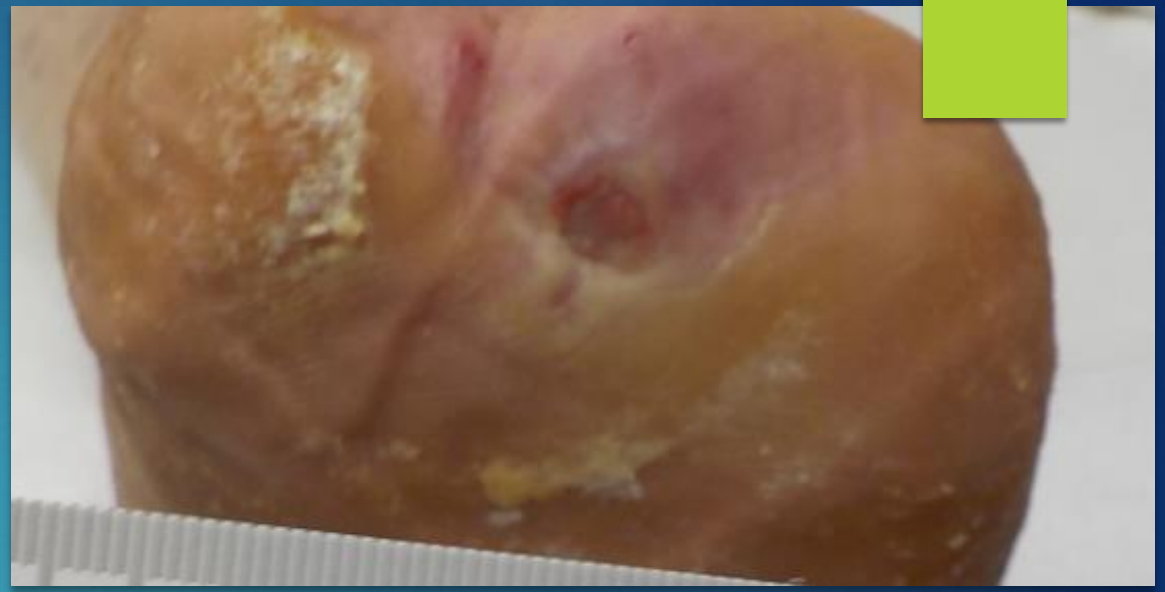
- Pathology of bone biopsies showed chronic osteomyelitis of Left third and fourth metatarsals.
- Treated with culture sensitive IV and PO antibiotics
- Labs after surgery and at time of antibiotics showed downtrend of CRP to normal and downtrend of ESR to almost normal.
  - ESR repeated at consultation was normal.
  - No overt signs of infection.
- …Recommend Total Contact Casting

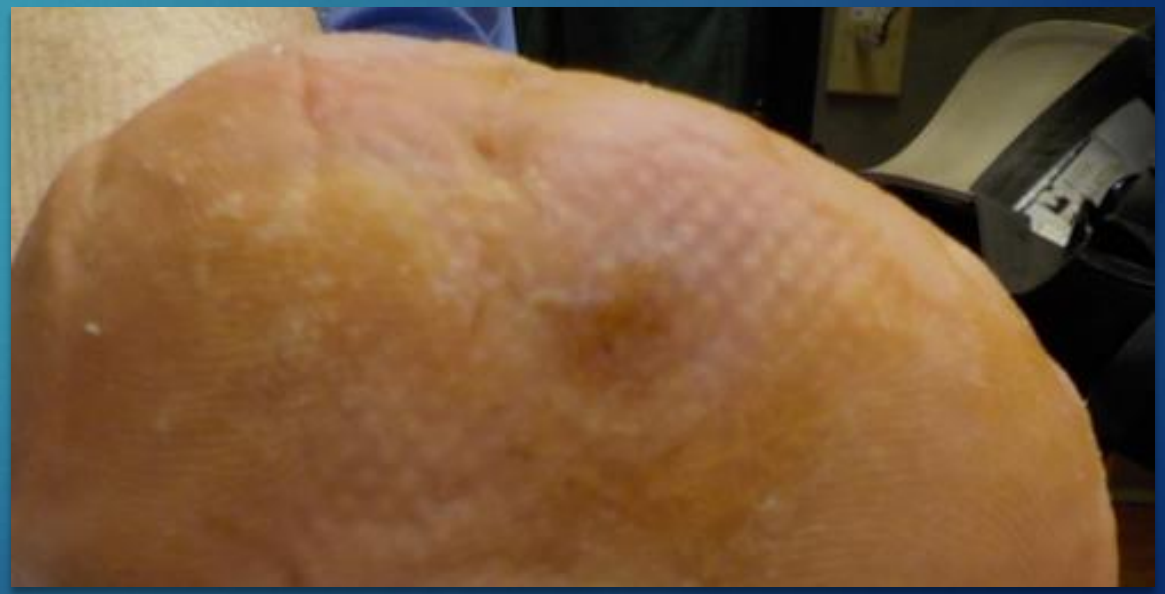
Case 3- Casting for Wound Healing

- 6 weeks
  - Comprehensive Wound Care
  - After TCC application

Time to heal

- 8 weeks
- Average time to heal
  - 3 months
  - 1/3 of ulcers never heal with amputation as the consequence





Thank you for your time.

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HaysMed Wound Healing and Hyperbaric Center

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