ANATOMY OF WOUND CARE

Arterial

Venous

Diabetic

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Traumatic

Surgical

Dallas PODIATRY Works

KEEPING YOU & YOUR LOVED ONES ACTIVE, MOVING & PAIN FREE.

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Dallas PODIATRY Works

GREETINGS,

At Dallas Podiatry Works,
we are committed to providing personalized care to manage and resolve your foot and lower extremity wounds. Wounds may be challenging to heal and pose problems for getting back on your feet. Thankfully, our podiatrists are experts at treating various types of foot wounds and determining the underlying cause. This is why we take the time to speak in-depth with you and address any risk factors that negatively affect wound healing.

For effective wound care management, our team of specialists draws from their extensive knowledge of foot care and lower extremity wound care while listening to your concerns and health history. We will answer any questions while assessing your condition, determining your goals, and creating a unique treatment plan for you. Our process is to educate you, so you are fully informed of your condition before beginning treatment. So, we've written this report as a helpful guide to the causes and types of wounds, wound treatment options, and how you can manage and prevent future wounds from developing.

We hope you find this useful on your journey to getting back on your feet. If you have any further questions, please feel free to reach out to our office. We will be happy to help you!

Sincerely,
Drs. Brook, Arroyo, Tran and McClurkin

Dallas PODIATRY Works

Types of Wounds 1

There are different types of wounds with varying root causes. Treatment will differ depending on the type, but most wounds have the same outcome if left untreated for an extended period – infection and amputation of the limb.

Arterial

Arterial ulcers (also known as ischemic ulcers) are caused by poor nutrient-rich blood delivery to the lower extremities. The surrounding skin is deprived of oxygen, killing the tissues and causing the area to form an open wound. Common risk factors include diabetes, high blood pressure, peripheral vascular disease, vasculitis (inflammation of blood vessels), kidney failure, heart disease, and limited joint mobility.

Symptoms of an arterial ulcer include:

- Deep, punched-out appearance
- Round, well-defined margins
- Pain relief from dangling the foot or leg over the side of the bed, which allows gravity to bring blood to the limb
- Yellow or grey tissue surrounding the ulcer

Arterial ulcers occur on the heels, tips of the toes, outer ankle, or anywhere with pressure from walking or footwear. The area surrounding the wound is often cold with no pulse. This type of wound is generally excruciating, especially at night, during rest, or while exercising. Treatment for this condition aims to increase circulation to the affected area.

Types of Wounds 2

Venous

Venous ulcers usually develop on the inner lower leg with redness and edema (swelling) at the ulcer site. They also may be painless. Distinctive features of a venous wound include:

- A shallow but large wound
- Irregular edges
- Usually appear red with rough tissue
- Surrounding skin is warm or shiny
- A dull, aching pain

Venous ulcers account for the majority of lower extremity wounds.

Diabetic

Patients who have diabetes for many years may develop neuropathy – nerve damage caused by uncontrolled, elevated blood glucose that leads to a reduced or lack of ability to feel pain in the feet. Neuropathy can occur without pain, meaning patients may not be aware of the problem and continually put excess pressure on their feet until a wound develops.

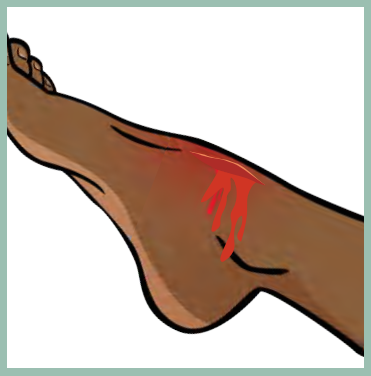
Other factors that increase the risk for a diabetic ulcer include poor circulation, bunions, hammertoes, ill-fitting shoes, and previous foot ulceration. Treatment includes reducing pressure on the feet to allow the wound to heal.

Types of Wounds 3

Pressure

Excessive pressure against the bottom of your foot causes the skin to thicken and form a callus. If the skin keeps thickening, the callus destroys the inner layers of skin and fat in the feet, leading to a pressure wound. Pressure wounds may quickly change from hot spots (signs of pressure or friction) to infected wounds.
This type of wound may drain, have discharge, bleed, or have a foul smell. If the wound is infected, the surrounding skin may become red or feel warm to the touch.

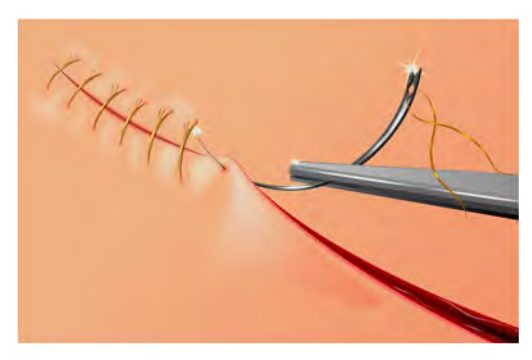
Traumatic



A laceration or puncture of the foot is a common injury resulting from stepping on a sharp object and occurs commonly in certain workplaces, such as construction sites. This type of wound may be immediately apparent or appear weeks after injury. Noticeable symptoms are a limp, a swollen and tender foot, and pain. A doctor may give the patient a tetanus booster shot shortly after the injury and debride the wound to prevent infection.

Types of Wounds 4

Surgical



After a foot or ankle surgery, there are protocols to follow for proper healing. The wound that remains needs to be cared for – cleaned and kept dry to ensure no infection results. If these instructions aren't followed, an infection can develop and lead to an ulcer.

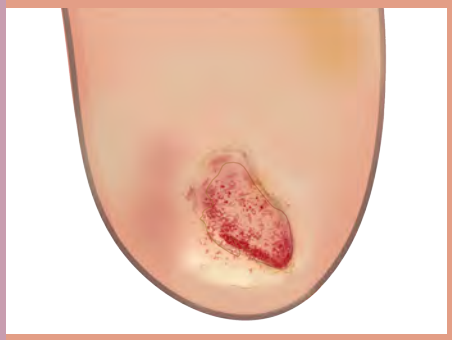
Depth of Wounds 1

For effective wound care and optimal healing, the depth of a foot or lower extremity wound will be visually examined and accurately measured during diagnosis.

a. Superficial Skin

A superficial skin wound involves only skin breakdown and loss of the epidermis (top layer of skin). This can include the beginning stages of ulcers and skin abrasions.

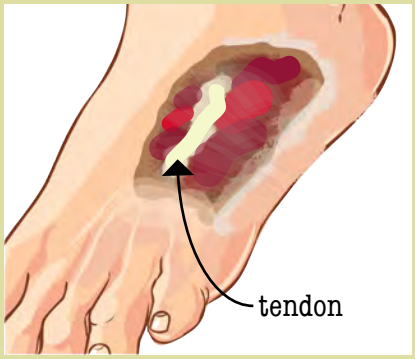
b. Subcutaneous tissue



This wound is deeper than a superficial wound. It involves the epidermis and edermis and exposes fatty tissue.

Depth of Wounds 2

c. Tendon or joint capsule



This wound depth exposes the tendon, capsule (the layer of tissue that surrounds the tendon), but not the bone.

d. Bone

This is a deep, full-thickness wound that exposes the bone. Resolution of this severe type of wound requires multiple treatment steps.

Appearance of Wounds 1

a. Granular

Granular wounds appear bumpy, moist, and light red or pink. This type is raised higher than the surrounding skin.

This tissue is the healthy, new connective tissue created when the area is successfully healing from an injury or wound.

b. Fibrotic

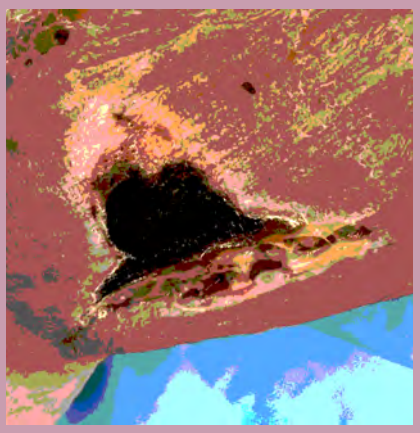
This refers to a scarred wound appearance or scarred tissue in a wound.

Appearance of Wounds 2

c. Necrotic

Necrosis refers to the buildup of dead tissue. Necrotic wounds occur when healthy skin or parts of the wound die off, leading to dead tissue that can delay wound healing. It is often necessary to remove the devitalized tissue before the doctor can heal the wound.

d. Escharotic



Devitalized tissue that appears thick, leathery, and is frequently black or brown. Dry eschar is firm, without drainage or swelling. It is attached to the wound base and edges. Soft eschar is either loosely or firmly attached to the wound base & edges, with possible drainage. It may be black, tan, grey, or brown.

Complications & Consequences of Wounds 1

If wounds are left untreated – especially deep or infected wounds – they will not go away on their own. You will experience worsening pain and infection with a delayed or non-healing wound. In some instances, limb amputations and hospitalization may be necessary.

a. Delayed or non-healing

Delayed or non-healing wounds must be addressed and treated by a podiatrist. A chronic wound is one that has shown no significant progress towards healing in 30 days. The causes of a chronic, non-healing wound may include continued pressure, infection, or loss of blood supply.

b. Infection

Open wounds are exposed to germs and bacteria in the environment. That means the risk of infection increases the longer a wound is left open and untreated. Infections can become severe, spread to the blood and bones, and lead to limb loss:

Complications & Consequences of Wounds 2

i. Cellulitis

Cellulitis is a common, potentially life-threatening bacterial skin infection that usually affects the lower legs.

The affected skin is warm and painful to the touch and appears red and swollen. If left untreated, the bacteria can spread to your lymph nodes & enter the bloodstream, which is life-threatening. Antibiotics can successfully treat cellulitis.

ii. Osteomyelitis

This is a severe infection of the bone that is common in those with diabetes, kidney failure, and foot ulcers.

Complications & Consequences of Wounds 3

iii. Sepsis

Sepsis is the body's extreme response to an untreated infection. It is a life-threatening condition that occurs when the bacteria from a wound enters the bloodstream, spreads to the organs, and causes organ damage. Symptoms include fever, difficulty breathing, low blood pressure, fast heart rate, mental confusion, and death.

c. Amputation

In the most serious cases, so much tissue may die off, or infection may become so serious that amputation of the toes, feet, or legs is the only option to preserve the patient's health.

Complications & Consequences of Wounds 4

d. Social & Psychological Costs

Not only can the physical complications of wounds be painful and life-threatening, but they can also cause social and psychological problems.

Chronic pain can inhibit your ability to live life freely, and the pain caused by letting wounds go untreated can stop you from a fulfilling, active lifestyle.

Patients often experience depression and anxiety due to their lack of freedom and embarrassment surrounding their wounds. They may not be able to walk without pain, feel embarrassed about the appearance of the wound. Additionally, going about daily activities may become difficult or even impossible without assistance.

Complications & Consequences of Wounds 5

e. Financial Costs

The complications of wounds extend past pain and social embarrassment. If a patient allows their condition to worsen, the cost of treating the wound is likely to increase as secondary infections and other issues develop. In cases of sepsis, serious infections, or amputations, hospitalization (possibly for an extended period) will be necessary.

Hospitalization and treatment of severe infections and amputations are expensive and require a lot of downtime for healing and follow-up appointments.

The amount of time needed for proper care sometimes interferes with recovering patients' ability to work and earn income, making it even more challenging to pay for medical costs.

It's much easier (and less painful) to visit our podiatrist at the first sign of a wound or if you need continued management of an existing one!

Types of Wound Closure

Different types of wound closures depend on the size, edges, and cleanliness of the wound. The three types of wound closure include:

a. Primary

Primary closure involves suturing or otherwise closing the wound to encourage quick healing. Clean wounds such as cuts, surgical incisions, and injuries with discernible edges can successfully close this way. Injuries heal quickly with this type of closure and usually have minimal scarring.

b. Secondary

This method allows a wound with devitalized edges (too large to be closed) to heal on its own with regular cleaning and dressing changes. Granulation tissue must fill in the wound, and the edges of the wound will contract to close the injury over time. This takes longer to heal than primary wound closure and creates more scar tissue.

c. Delayed Primary

This is also known as healing by tertiary intention and combines primary and secondary closures. The wound is first cleaned and then observed for a few days to ensure no infection is present. It is then surgically closed and monitored for proper healing.

Local Wound Care Treatment Modalities 1

1. Cleaning Agents

Most wounds will need to be thoroughly cleaned before moving on to any surgical procedures, antibiotics, or wound dressings. Some common cleaning agents include: **saline, Dakin's solution (sodium hypochlorite), betadine, and chlorhexidine.**

2. Debridement

Debridement simply means removing dead or infected tissue to facilitate wound healing. Debriding a wound helps healthy tissue grow back and minimizes scarring.

a. Surgical

Surgical debridement involves cutting off unhealthy tissue with tools such as scalpels.

b. Mechanical

Mechanical debridement uses force to remove tissue. Common methods include hydrotherapy, wet-to-dry dressing, and brushing debridement pads across the wound to remove debris and tissue.

Local Wound Care Treatment Modalities 2

2. **Debridement (cont.)**

   c. **Enzymatic**

   Enzymatic debridement uses a collagenase medication that contains special enzymes that soften unhealthy tissue. This medication is applied once or twice daily and the wound is covered with a dressing. When the dressing is removed, dead tissue comes with it.

3. **Wound Dressings**

Wounds need to be covered with dressings and possibly ointments to encourage proper healing. Depending on the state of the wound, a doctor may employ some of the following.

   a. **Hydrogels**

   For dry wounds, pressure ulcers, and painful and necrotic wounds, a wound care specialist may use Hydrogel. It is also indicated for second-degree burns and infected wounds.

Local Wound Care Treatment Modalities 3

3. **Wound Dressings (cont.)**

   b. **Alginates and Foams**

   These dressings are best for highly exudative wounds, burns, venous ulcers, and wounds with large amounts of drainage.
   Alginates contain sodium that absorbs the excess liquid and creates a gel to heal the wound faster.

   c. **Collagens**

   Collagen dressings create a scaffolding that stimulates new cell growth, aids the formation of new blood vessels, brings the wound edges together, and removes dead tissue. This encourages the wound to heal faster.

   d. **Enzymatic Debriders**

   Collagenase is an ointment that contains special enzymes that gently remove dead tissue from fibrotic and necrotic wounds.

Local Wound Care Treatment Modalities 4

3. **Wound Dressings, cont.**

    e. **Growth Factors**

    These dressings, such as Regranex, are derived from human platelet growth factors and stimulate the regrowth of healthy skin cells to speed up wound healing.

4. **Compression**

    Compression is a method used to speed up the wound healing process. It reduces swelling by shifting excess fluid in the legs back into the blood vessels. This reduces edema around the wound, and the pressure also limits the veins' ability to expand, preventing blood clots and improving blood flow. It is an effective option for most patients but may not be recommended for those with heart problems, neuropathy, or skin infections. **Methods of compression include compression socks or stockings, Ace bandages, Unna's boots and other layered wraps.**

Local Wound Care Treatment Modalities 5

5. **Offloading**

    Wounds on the bottom of the foot must be offloaded, meaning the patient needs to stay off the foot and avoid putting any pressure on the wound to facilitate healing. Patients may be prescribed special footgear, castings, or a brace to reduce friction and irritation of the wound. **This includes total contact casting, custom molded orthotics, waffle or Multipodus boots, or Orthowedge shoes. The patient may also be instructed to remain partially or completely non-weightbearing to the effected foot using a walker, crutches, or other assistive devices.**

Advanced Wound Care Modalities

In more severe wounds, a wound care specialist will employ advanced treatment methods.

a. Negative Pressure Wound Vac Therapy

With this vacuum-assisted wound closure technique, sub-atmospheric pressure is applied to provide positive pressure to the wound surface. A dressing is sealed over the wound and a gentle vacuum pump is attached to the dressing. This method draws out fluid and infection from a wound and helps the wound's edges close to assist in healing.

b. Wound Graft

Grafting is the process of transplanting skin or placing a bioengineered substitute to replace the lost skin from a burn or wound. They rely on the blood supply from the wound for nutrients and are sometimes placed so a large wound can heal properly.

i. Bioengineered Skin Substitutes

This includes **human skin allografts, matrices that contain metabolically active or regenerative components, or acellular matrices.**

Advanced Wound Care Modalities 2

1. Human skin allografts

Human skin allografts are bioengineered using healthy human skin components and are employed to fill in soft tissue.

2. Leneva® Allograft Adipose Matrix

One groundbreaking human skin allograft is the Leneva® Allograft Adipose Matrix that uses human fat for tissue reconstruction. It is a safe and all-natural injectable solution for the treatment of diabetic foot ulcers, tunneling wounds, pressure ulcers, and fat pad reconstruction.
Leneva provides an extracellular matrix for the cells to create new fat and rebuild tissue. It is safe, quality controlled, available off-the-shelf, and may help prevent ulcer recurrence.

3. Allogeneic matrices

This substitute contains metabolically active or regenerative components that help the wound heal.

Advanced Wound Care Modalities 3

4. **Composite matrices**
   These are usually derived from skin cells of the top layer of skin (epidermis) and are supported by a mesh scaffold.

5. **Acellular matrices**
   Acellular matrices simulate the characteristics of human skin and promote healing, encouraging natural closure of the wound.

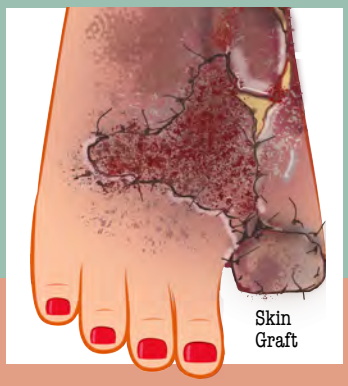
ii. Skin Grafting

The following types of skin grafts are procedures in which skin is taken from a part of your own body and grafted to the wound to promote healing. They consist of the epidermis and a varying thickness of the dermis.

1. **Split-thickness skin graft**
   Split-thickness skin grafts consist of the epidermis and a thin part of the dermis that allows the graft to attach to the wound site.

Advanced Wound Care Modalities 4

2. **Full-thickness skin graft**
   Full-thickness skin grafts contain the epidermis and the entire dermis. They provide a better cosmetic result and are more durable than split-thickness skin grafts.



c. Hyperbaric Oxygen

Hyperbaric oxygen therapy exposes the body to 100% oxygen at a higher pressure than normal. The patient goes into a pressurized chamber filled with oxygen to increase oxygen concentration in their bloodstream. As wounds require oxygen to heal, hyperbaric oxygen therapy can positively affect wound healing, increasing growth factors in the skin and improving cellular function.

Wound Prevention 1

While there are many effective treatment options for wound care, prevention is always best – you can avoid life-threatening complications with some simple measures and precautions.

Diabetes

Poorly controlled diabetes is a significant factor in developing neuropathy, ulcers, and infected wounds. Effectively managing this condition can help prevent wound development.

i. **Control blood sugar**

High glucose can delay healing. Frequently check your blood sugar to ensure that it stays within a normal range by following your doctor's diet guidelines.

ii. **Check feet daily for wounds**

Diabetic people may not feel an injury or cut on their foot due to reduced sensitivity. Check daily for small injuries as they can quickly become a large wound.

iii. **Wash feet with warm water daily**

Keep your feet clean to prevent the development of fungus.

iv. **Apply lotion to feet daily**

Lotion can help prevent the development of calluses, thus reducing friction and preventing pressure ulcers.

v. **Keep spaces in between toes dry**

This can help you avoid fungal infections.

vi. **Do not cut corns/calluses/ nails yourself**

Cutting corns, calluses, or nails by yourself can create lacerations and lead to ulcers. This is especially important if you can't feel your feet, as you don't know if you're causing damage or not. It's best to see a podiatrist for regular foot maintenance or if you have a corn or callus.

vii. **Wear protective shoe gear with appropriate offloading**

Protective shoes and special footgear can help prevent friction and stop the initial development of calluses and ulcers.

Edema

Limb swelling (edema) can severely inhibit proper and timely wound healing. Preventing or controlling edema is essential in preventing the development of wounds.

Wound Prevention 2

Edema, (cont.)

i. **Wear a form of compression throughout the day**

Compression socks, tubes, or bandages reduce limb swelling. Wearing these daily can help prevent ongoing swelling from recurring.

ii. **Elevate lower extremities as much as possible**

Elevation of the lower extremities encourages the extra fluid to move away from the swollen area and back towards the heart for recirculation.

iii. **Manage weight**

Excess weight can strain your feet and staying sedentary can cause water retention in the lower limbs. Follow steps, such as eating a healthy diet, to manage your weight.

iv. **Avoid salt**

Salt makes your body retain water, which worsens edema. Controlling your salt intake can prevent fluid retention. Always check with your doctor for nutrition and diet instructions.

v. **Compression therapy**

At-home compression devices may be recommended for those who cannot wear compression stockings or socks.

General

- **Wear appropriate shoe gear that fits well**

  Wear shoes that fit well. For those with known pressure areas on their feet, offloading shoes can help prevent the initial development of calluses and their resulting wounds.

- **Change damp socks regularly**

  Dry, clean socks are essential for proper foot health and prevent the growth of fungus and bacteria.

- **Avoid going barefoot**

  This prevents cuts, scrapes, or other injuries that can lead to wounds. Wearing protective shoes is especially crucial if a patient has neuropathy or numb feet.

- **Do not use nicotine products**

  Any products containing nicotine constrict the blood vessels, reduce blood flow to the feet and limbs, impede healing, and are bad for overall health.

DEAR FRIEND,

We hope this report has provided you with more knowledge of the different types of wounds and techniques we can employ for your healing process. To accomplish our mission of improving quality of life and restoring our patients' healthy, active lifestyles, we would be honored to meet you and learn more about how we can help manage your foot care or assist in healing your wounds.

Our compassionate team is here to address your concerns, answer your questions, and help you experience podiatry and wound care at its very best.

We will share our expert medical recommendations based on our thorough analysis, our years of experience, and our advanced diagnostics. Our pride is in providing excellent foot care, preventing complications from wounds, and helping you heal and get back on your feet! Please contact us with any concerns or further questions about our expert wound care: **972.435.9864.**

To Your Foot Health,

Drs. Brook, Arroyo, Tran, McClurkin
&
Your Dallas Podiatry Works Team

Dallas PODIATRY Works