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From Chronic to Acute:

THE IMPORTANT ROLE OF DEBRIDEMENT IN WOUND HEALING

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From Chronic to Acute:

THE IMPORTANT ROLE OF DEBRIDEMENT IN WOUND HEALING

by Cheryl Carver LPN, WCC, CWCA, CWCP, DAPWCA, FACCWS, CLTC – Wound Educator

Debridement is used to remove dead, necrotic, or foreign material from a wound. There are many methods of debridement, which are reviewed by definition and by indication. There are debridement methods that may be frowned on in certain health care arenas, as well. Surgical and conservative sharp methods of debridement are considered invasive because of the use of surgical instruments. Health care practitioners should follow their individual state licensure boards' professional scope of practice *and* facility policy for physicians, nurse practitioners, and physician assistants.[1]

To have a clear understanding and true knowledge of chronic wounds, you must first understand the three layers of the skin structure: the epidermis, dermis, and subcutaneous layer. Each layer of the skin structure has a distinctive job to perform.

1. **Epidermis –** This is the outermost layer of the skin and is divided into five layers of stratum corneum. It is approximately 1.5 mm thick and provides a waterproof barrier, has no blood vessels, and is also responsible for skin tone.

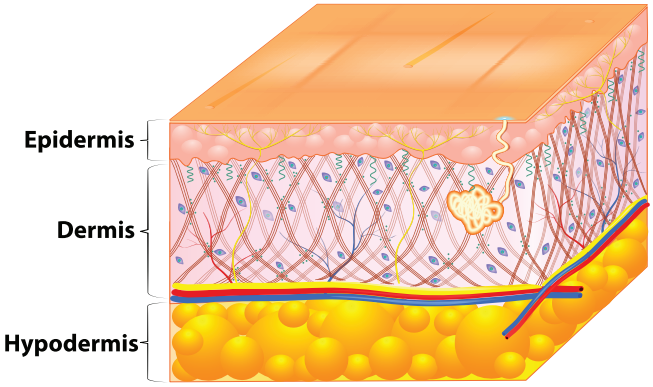
2. **Dermis –** This layer is beneath the epidermis. It contains tough connective tissue, hair follicles, nerves, sweat glands, capillaries and arterioles.

3. **Subcutaneous –** This deeper layer is made of fat, connective tissue and blood vessels. It is also called the hypodermis.

A wound is an injury to the skin and or underlying tissue, which may or may not be open. The wound healing process is a systematic process of cellular functions from start to wound closure. If the cascade of wound healing is disturbed, we have a chronic wound.

"The wound healing process is a systematic process of cellular functions..."

To gain a better understanding, wounds can be divided several different ways into categories.



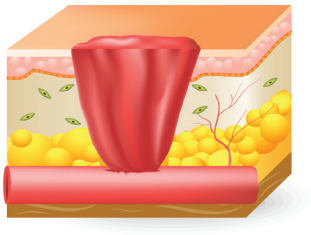
1. Partial-thickness wounds, full-thickness wounds

- Partial-thickness wounds involve the epidermis and part of the dermis layers.
- Full-thickness wounds extend deeper into the subcutaneous tissue and even into muscle and bone.

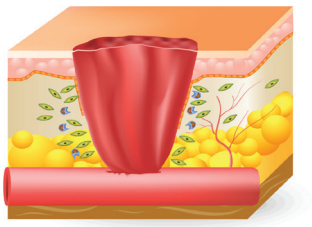
2. Acute wounds, chronic wounds

- An acute wound heals or closes within an anticipated time frame.
- Chronic wounds are wounds that "stall" in the inflammatory phase. There are many contributing factors that can affect the "normal" healing process. Most wounds that have not shown signs of healing in 90 days are considered chronic.

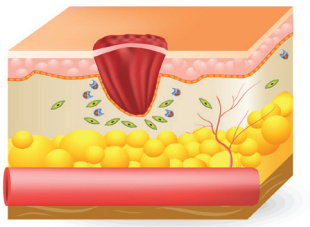
Wound Healing Cascade



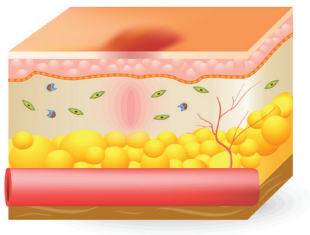
Hemostasis – Hemostasis starts within the first 15 minutes of an injury that extends through the epidermis into the dermis. Capillaries provide blood supply in the dermis layer of skin structure. When an injury occurs to the vessels, coagulation activation begins. Platelet aggregation and activation create clot formation. Growth factors are then released, which is called fibrinolysis. Vasoconstriction will then finish the process of this phase.[2]



Inflammatory (1 to 5 days) – During the inflammatory phase you may see "normal" physiological changes, such as erythema, warmth, pain, and localized edema. This is where cell growth and activation, as well as re-epithelialization, occur.[2]



Proliferative (5 to 25 days) – This phase can take place only in a full-thickness wound. This would include a stage III and IV pressure injury/ulcer. Granulation develops during this phase.[2]



Maturation (21 days to 24 months) – This is the final phase of full-thickness wounds for the healing cascade. You may also see it referred to as the "remodeling" phase. Scar tissue tensile strength will reach only 80% compared with the original tissue.[2]

"Scar tissue tensile strength will reach only 80% compared with the original tissue."

Methods of Debridement

There are five major types of non-selective and selective debridement methods, but many factors determine what method will be most effective for your patient. BEAMS is an acronym that is widely used to remember the five types.[3]

1 Biological debridement is the use of maggots, *Lucilia sericata* (green bottle fly), that are grown in a sterile environment and digest dead tissue and pathogens.[4]

2 Enzymatic debridement is performed by the application of a prescribed topical agent that chemically liquefies necrotic tissues with enzymes. These enzymes dissolve and engulf devitalized tissue within the wound matrix. Antimicrobial agents used in conjunction with collagenase can decrease enzymatic debridement effectiveness. This method can be used in conjunction with surgical and sharp debridement.[4]

3 Autolytic debridement is the slowest method, and it is most commonly used in the long-term care arena. There is no pain with this method. This method uses the body's own enzymes and moisture beneath a dressing, and non-viable tissue becomes liquefied. Maintaining a balance in moisture is important. Dressing types commonly used are hydrocolloids, hydrogels, and transparent films (semi-occlusive and occlusive).[4]

4 Mechanical debridement occurs by irrigation, hydrotherapy, use of wet-to-dry dressings, and abraded technique. This technique is cost-effective, can damage healthy tissue, and is usually painful. Wet-to-dry dressings are frowned on in the long-term care setting by state surveyors because of the options available with advanced wound care dressings.[4]

5 Surgical sharp and conservative sharp debridement are performed by a skilled practitioner using surgical instruments such as scalpel, curette, scissors, rongeur, and forceps. The level of debridement is determined by what tissue is removed.[4]

"Autolytic debridement is the slowest method, and it is most commonly used in the long-term care arena."

Combined Debridement Advantages

Combining debridement methods has been found to be advantageous in managing complex wounds and different pathological tissues since 2006.[5,6] In recent years, there have been many new types of debridement technology, such as fluid jet technology, ultrasound debridement therapy, hydrosurgery, and use of monofilament polyester fiber pads.[7,8] All of these methods complement each other in an overall wound management plan of care.

Why Debride Wounds?

First, to assess or evaluate a wound properly, we must be able to visualize the wound bed tissue level. Non-viable or devitalized tissue not only slows down the wound healing process but also increases the risk of infection and sepsis. Dead tissue or foreign material is a vehicle for bacterial growth. The goal of debridement is to make the wound acute again and thereby to expedite healing in an orderly fashion.[3,9]

"Developed biofilms harbor physical and metabolic defenses."

Second, biofilm formation is present in 60% to 90% of chronic wounds. Developed biofilms harbor physical and metabolic defenses. These defenses enable the biofilm to resist antimicrobials that usually alienate planktonic cells and include resistance to host defenses, biocides, antibiotics, and ultraviolet light. Sequential sharp debridement of wounds disrupts biofilm growth and inhibitory factors and can promote faster healing. It is difficult to predict the outcome because we still do not know the depth needed to remove the entire biofilm colony.[3,9]

Hypergranulation and Epibole Management

The silver nitrate stick is considered an antimicrobial and is used in enhancing anti-inflammatory healing. A silver nitrate stick uses a chemical cautery agent made up of 75% silver nitrate and 25% potassium nitrate. When the tip of the applicator stick is moistened by wound fluid, a chemical reaction occurs: killing bacteria, removing necrotic tissue, reducing hypergranulation, reducing fibroblast proliferation, and coagulating tissue.

Hypergranulation, known as "proud flesh," is overgrown granulation tissue above the normal wound bed surface level. It is identified as red, friable, moist, and shiny tissue. A silver nitrate stick can be used to reduce hypergranulation by rolling the tip of the silver nitrite stick over the wound tissue. This application process will jump start the healing cascade over again as an acute wound.

Epibole can be a common problem in full-thickness wounds. Wounds normally fill in from the bottom up while the wound edges pull together as epithelial cells

migrate across the wound surface from all sides and meet in the middle. When the epidermal cells move sideways instead of across the wound, the edges are then rolled or curled under, this condition is considered epibole. Epibole-type wound edges can be treated several ways, to jump start the healing process.

1. Silver nitrate application to the wound edges

2. Sharp debridement of wound edges

3. Mechanical debridement, by abrading with a gauze dressing to the edges

When Is Debridement Contraindicated?

Current standard of care guidelines recommend that stable, intact (dry, adherent, intact without erythema or fluctuance) eschar on the heels should not be removed. Poor blood flow beneath the eschar warrants high susceptibility to infection. Eschar works as a natural barrier protecting the wound bed from bacteria. If the eschar becomes unstable (wet, draining, loose, boggy, edematous, red), it should be debrided according to the clinic or facility protocol.[10]

"Eschar works as a natural barrier protecting the wound bed from bacteria."

Autoimmune and pyoderma gangrenosum wound types tend to worsen with sharp debridement when there is a prominent, active border. This is the result of triggering an inflammatory response known as "pathergy."[11] Patients receiving immunosuppressive therapy, with non-active border clinical signs as mentioned, can receive surgical debridement.[12]

Calciphylaxis wounds with expanding tissue necrosis and a violaceous border should not be surgically debrided. The patient must also complete sodium thiosulfate therapy, along with clinical observations that necrosis expansion has stopped, and the violaceous border is no longer present.[12]

Patient Education Leads To Better Outcomes

Patient education should be first and foremost to reduce anxiety, manage expectations, and promote good outcomes with the treatment plan. Discuss the procedure and any local or topical anesthetics being used for pain control during the debridement procedure. Anesthetic agents such as lidocaine (with and without epinephrine) injectables, topical gels, sprays, and ointments are available to control pain at the wound site for clinic or bedside debridement procedures. Independent providers may have their own preferences or may follow the health care facility protocol.

Wound Tissue Types And Debridement Methods

	Epithelial	Scab	Granulation	Slough	Eschar	Exposed Structure (Muscle, Fascia, Tendon, Bone)
Color	Light Pink	Brown Black	Pink Red Dusky	Yellow Cream Tan	Black	Dark Pink
Consistency	Smooth Shiny	Crusty Dry Cracked	Beefy Non-Viable Hypergranu-lation Hypogranu-lation	Fibrinous Adherent Stringy	Stable Dry Intact Soft	Dry Soft Collapsed
Debridement Method	Not Indicated	Autolytic Mechanical Sharp/ Surgical	Managing Biofilm: Autolytic Mechanical Sharp/ Surgical	Autolytic Enzymatic* Mechanical Sharp/ Surgical Biological Ultrasonic	Autolytic Enzymatic* Mechanical Sharp/ Surgical Biological Ultrasonic	Surgical Enzymatic* Biological

*Enzymatic (Is Safe To Use Until Wound Closure)[5]

Scab Versus Eschar

The term *eschar* is NOT interchangeable with scab. Eschar is dead tissue found in a full-thickness wound. You may see eschar after a burn injury, gangrenous ulcer, fungal infection, necrotizing fasciitis, spotted fevers, and exposure to cutaneous anthrax. Current standard of care guidelines recommend that stable, intact (dry, adherent, intact without erythema or fluctuance) eschar on the heels should not be removed. Blood flow in the tissue under the eschar is poor, and the wound is susceptible to infection. The eschar acts as a natural barrier to infection by keeping the bacteria from entering the wound. If the eschar becomes unstable (wet, draining, loose, boggy, edematous, red), it should be debrided according to the clinic or facility protocol.[10]

The term *scab* is used when a crust has formed by coagulation of blood or exudate. Scabs are found on superficial or partial-thickness wounds. A scab is the rusty brown, dry crust that forms over any injured surface on skin within 24 hours of injury. Whenever our skin is injured as a result of any cut or abrasion, it starts bleeding because of blood flowing from the severed vessels. This blood—containing platelets, fibrin, and blood cells—soon clots to prevent further blood loss. The outer surface of this blood clot dries up (dehydrates) to form a rusty brown crust, called a scab, which covers the underlying healing tissues like a cap. The purposes of a scab are to prevent further dehydration of the healing skin underneath, to protect the skin from infections, and to prevent any entry of contaminants from the external environment. Scabs generally remain firmly in place until the skin underneath has been repaired and new skin cells have appeared, after which the scab naturally falls off.[10]

"The purposes of a scab are to prevent further dehydration of the healing skin underneath, to protect the skin from infections, and to prevent any entry of contaminants from the external environment."

Conclusion

Debridement methods should complement the wound healing process. Performing an accurate assessment of tissue types is also important. Devitalized tissue in the wound bed lengthens the inflammatory phase of healing and increases the risk of infection. The provider should conduct a history and physical examination and ask questions regarding previous wounds and medical problems. Identifying the most suitable debridement method, along with the appropriate advanced wound care dressing, is most effective in optimizing wound healing progress.

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Use of SANTYL Ointment should be terminated when debridement is complete and granulation tissue is well established.

One case of systemic hypersensitivity has been reported after 1 year of treatment with collagenase and cortisone. Occasional slight transient erythema has been noted in surrounding tissue when applied outside the wound.

Please see complete Prescribing Information on adjacent page.

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DESCRIPTION
Collagenase Santyl® Ointment is a sterile enzymatic debriding ointment which contains 250 collagenase units per gram of white petrolatum USP. The enzyme collagenase is derived from the fermentation by *Clostridium histolyticum*. It possesses the unique ability to digest collagen in necrotic tissue.

CLINICAL PHARMACOLOGY
Since collagen accounts for 75% of the dry weight of skin tissue, the ability of collagenase to digest collagen in the physiological pH and temperature range makes it particularly effective in the removal of detritus.[1]

Collagenase thus contributes towards the formation of granulation tissue and subsequent epithelialization of dermal ulcers and severely burned areas.[2, 3, 4, 5, 6] Collagen in healthy tissue or in newly formed granulation tissue is not attacked.[2, 3, 4, 5, 6, 7, 8] There is no information available on collagenase absorption through skin or its concentration in body fluids associated with therapeutic and/or toxic effects, degree of binding to plasma proteins, degree of uptake by a particular organ or in the fetus, and passage across the blood brain barrier.

INDICATIONS AND USAGE
Collagenase Santyl® Ointment is indicated for debriding chronic dermal ulcers[2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18] and severely burned areas.[3, 4, 5, 7, 16, 19, 20, 21]

CONTRAINDICATIONS
Collagenase Santyl® Ointment is contraindicated in patients who have shown local or systemic hypersensitivity to collagenase.

PRECAUTIONS
The optimal pH range of collagenase is 6 to 8. Higher or lower pH conditions will decrease the enzyme's activity and appropriate precautions should be taken. The enzymatic activity is also adversely affected by certain detergents, and heavy metal ions such as mercury and silver which are used in some antiseptics. When it is suspected such materials have been used, the site should be carefully cleansed by repeated washings with normal saline before Collagenase Santyl® Ointment is applied. Soaks containing metal ions or acidic solutions should be avoided because of the metal ion and low pH. Cleansing materials such as Dakin's solution and normal saline are compatible with Collagenase Santyl® Ointment.

Debilitated patients should be closely monitored for systemic bacterial infections because of the theoretical possibility that debriding enzymes may increase the risk of bacteremia.

A slight transient erythema has been noted occasionally in the surrounding tissue, particularly when Collagenase Santyl® Ointment was not confined to the wound. Therefore, the ointment should be applied carefully within the area of the wound. Safety and effectiveness in pediatric patients have not been established.

ADVERSE REACTIONS
No allergic sensitivity or toxic reactions have been noted in clinical use when used as directed. However, one case of systemic manifestations of hypersensitivity to collagenase in a patient treated for more than one year with a combination of collagenase and cortisone has been reported.

OVERDOSAGE
No systemic or local reaction attributed to overdose has been observed in clinical investigations and clinical use. If deemed necessary the enzyme may be inactivated by washing the area with povidone iodine.

DOSAGE AND ADMINISTRATION
Collagenase Santyl® Ointment should be applied once daily (or more frequently if the dressing becomes soiled, as from incontinence). When clinically indicated, crosshatching thick eschar with a #10 blade allows Collagenase Santyl® Ointment more surface contact with necrotic debris. It is also desirable to remove, with forceps and scissors, as much loosened detritus as can be done readily. Use Collagenase Santyl® Ointment in the following manner:

1 – Prior to application the wound should be cleansed of debris and digested material by gently rubbing with a gauze pad saturated with normal saline solution, or with the desired cleansing agent compatible with Collagenase Santyl® Ointment (See **PRECAUTIONS**), followed by a normal saline solution rinse.

2 – Whenever infection is present, it is desirable to use an appropriate topical antibiotic powder. The antibiotic should be applied to the wound prior to the application of Collagenase Santyl® Ointment. Should the infection not respond, therapy with Collagenase Santyl® Ointment should be discontinued until remission of the infection.

3 – Collagenase Santyl® Ointment may be applied directly to the wound or to a sterile gauze pad which is then applied to the wound and properly secured.

4 – Use of Collagenase Santyl® Ointment should be terminated when debridement of necrotic tissue is complete and granulation tissue is well established.

HOW SUPPLIED
Collagenase Santyl® Ointment contains 250 units of collagenase enzyme per gram of white petrolatum USP.

Do not store above 25°C (77°F). Sterility guaranteed until tube is opened.

Collagenase Santyl® Ointment is available in the following sizes:
30 g tube NDC 50484-010-30
90 g tube NDC 50484-010-90

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