DRESSINGS IN SURGERY

Basic principles

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DRESSINGS

a) provide a temporary protective physical barrier,
b) absorb wound drainage, and
c) provide the moisture necessary to optimize re-epithelialization

TEMPORARY PROTECTIVE BARRIER

- Open wounds
  - Higher rate of infection
- Sutured wounds
  - Initial protection of the suture lines

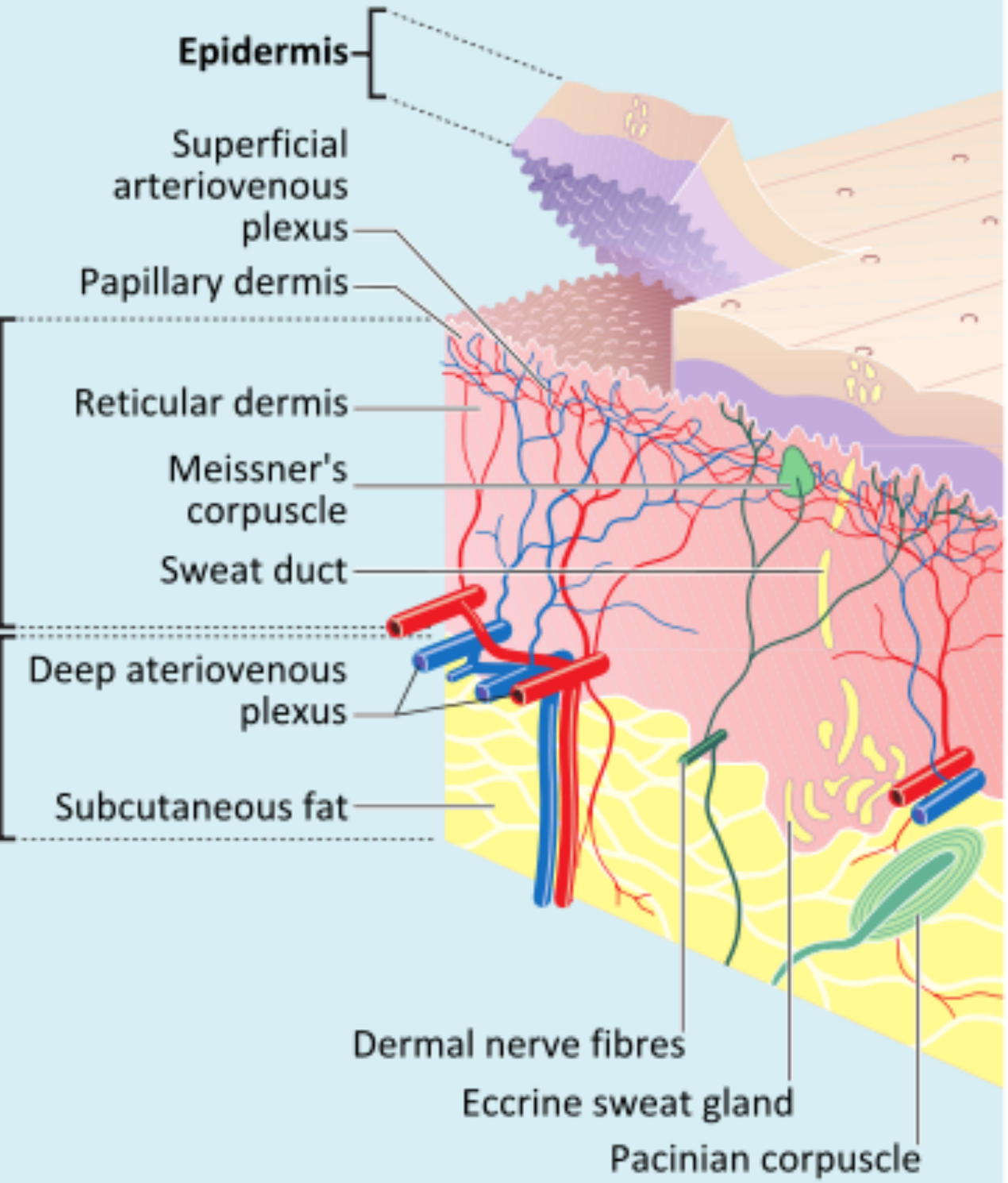
MANAGING THE EXUDATE

- Anticipation of the exudate
- Assessment of the exudate
- Targeting the optimal exudate
- Treating the exudate
- Dressings for exudate

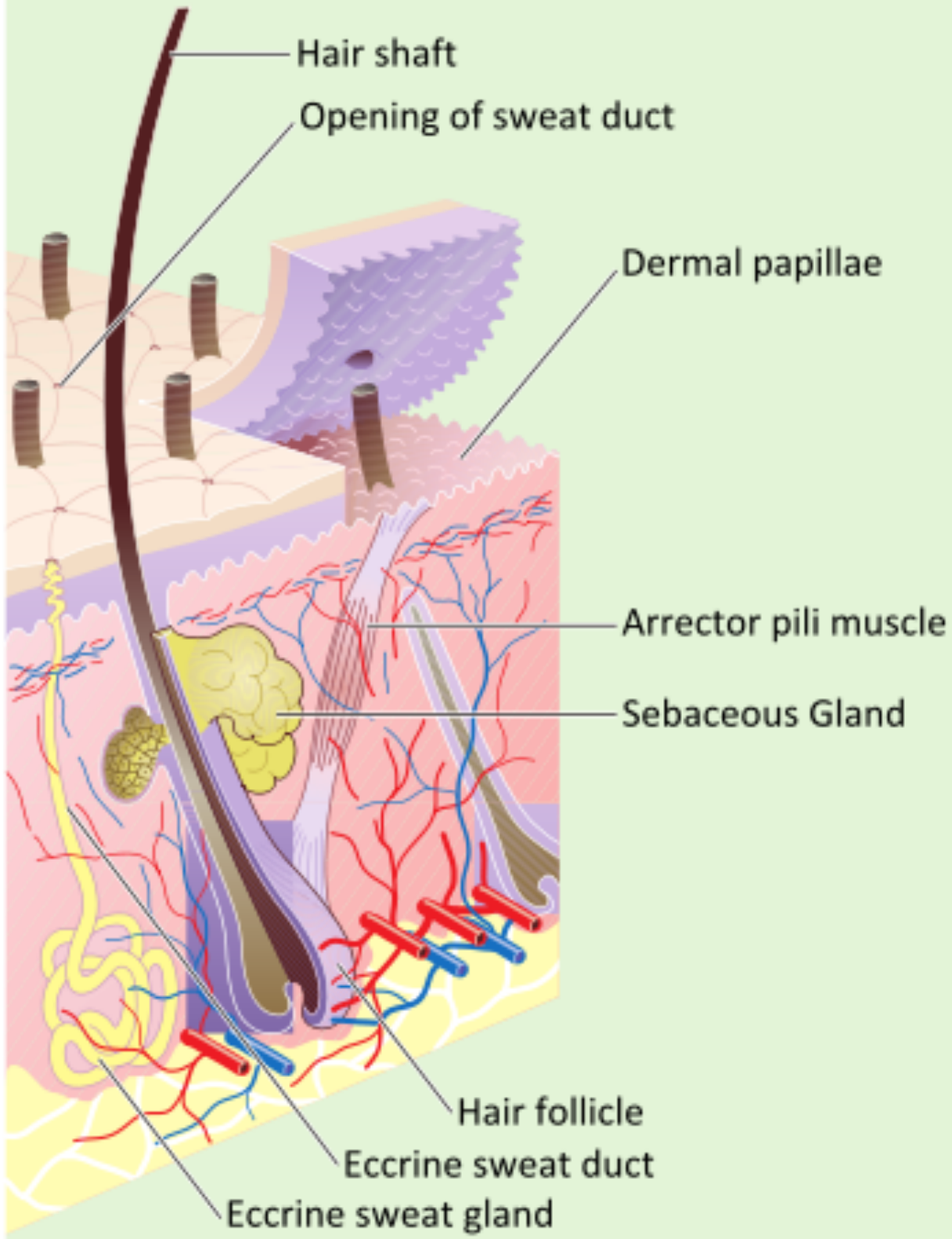
Table I
Management approach for non-infected wounds

	Granular	Necrotic
Draining	◆Goal is to protect granulation tissue and periwound area. ◆Use absorptive dressings, gauze, alginates/hydrofibers, semi-permeable foams, or hydrocolloids.	◆Goal is to debride the wound area, absorb drainage, protect surrounding tissue, and monitor/prevent infection. ◆Use gauze and alginate/hydrofibers, less commonly foam or hydrocolloid dressings.
Non-Draining	◆Goal is to continue proper wound healing. Select a dressing that can balance the right moisture and occlusiveness. ◆Use impregnated gauze, films, and hydrogels.	◆Goal is to debride carefully, soften eschar, and balance appropriate moisture. ◆Use impregnated gauze, films, hydrogels, and hydrocolloids.

Thick skin (hairless)



Thin skin (hairy)



TERMINOLOGY

Epidermis: Is the outer layer of the skin.

- comprised of epithelial cells
- avascular
- 0.04mm thick
- regenerated every 2-4weeks, subject to an individual's age and friction forces applied to the skin
- receives nutrients from the dermis below
- comprised of 4 to 5 layers depending on the body location

Dermis: Is the middle layer of the skin and is approximately 0.5mm thick subject to anatomical site

- made up of two layers
- is very vascular
- contains nerves, connective tissue, collagen, elastin and specialized cells such as fibroblasts and mast cells
- responsible for inflammatory reactions which occur in response to trauma and infection
- receptors for heat, cold, pain, pressure, itch and tickle

Hypodermis: Is the inner most layer of the skin and is referred to as the subcutaneous layer

- supports the dermis and epidermis
- varies in thickness and depth
- comprised of adipose tissue, connective tissue and blood vessels
- the function is to store lipids, protect underlying organs, provide insulation and regulate temperature

Skin Appendages: Includes Sweat glands, hair, nails and sebaceous glands which are all considered epidermal appendages.

Definition of Terms

Acute Wound: is the result of tissue damaged by trauma. This may be deliberate, as in surgical wounds of procedures, or be due to accidents caused by blunt force, projectiles, heat, electricity, chemicals or friction.

An acute wound is by definition expected to progress through the phases of normal healing, resulting in the closure of the wound.

A Chronic Wound fails to progress or respond to treatment over the normal expected healing time frame (4 weeks) and becomes "stuck" in the inflammatory phase.

Wound chronicity is attributed to the presence of intrinsic and extrinsic factors including medications, poor nutrition, co-morbidities or inappropriate dressing selection

Types of Wounds throughout

Acute Surgical Wounds

A clean cut with a sharp instrument which cuts or punctures the skin deliberately during a surgical procedure. Acute surgical wounds normally proceed through an orderly and timely reparative process resulting in sustained restoration of anatomic and functional integrity. If an acute wound fails to heal within six weeks, it can become a chronic wound.

Trauma Wounds

A stressful event caused by either a mechanical or a chemical injury resulting in tissue damage. Depending on its level, trauma can have serious short-term and long-term consequences.

Burns

Injuries to tissues caused by heat, friction, electricity, radiation, or chemicals. Burns may be caused by even a brief encounter with heat greater than 120°F (49°C). The source of this heat may be the sun , hot liquids, steam, fire, electricity, friction (causing rug burns and rope burns), and chemicals (causing a caustic burn upon contact).

Chronic Wounds

Fail to heal in an orderly and timely manner. The chronic wound environment is different to the acute wound environment. The clinical signs of chronic wounds may include:

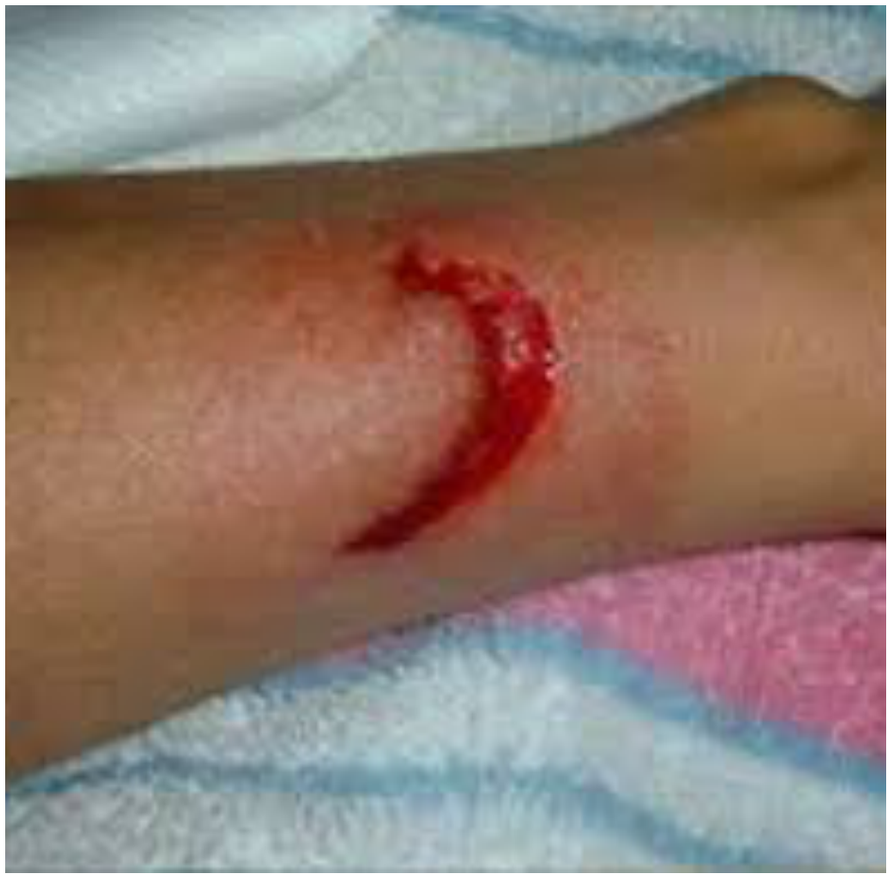
- Non viable wound tissue (slough and/or necrosis)
- Lack of healthy granulation tissue (wound tissue may bepale, greyish and avascular)
- No reduction in wound size over time
- Recurrent wound breakdown

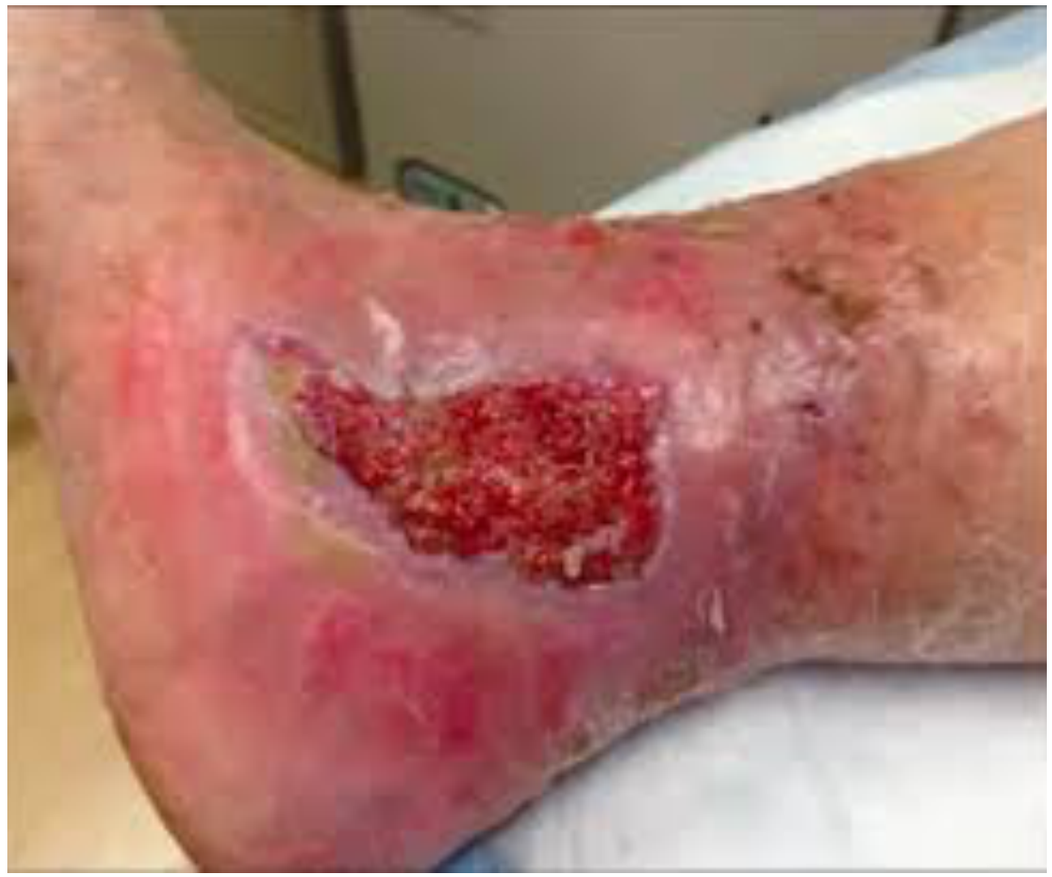
Pressure Injuries

A localised injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, shear and/or friction, or a combination of these factors.

Infected Wounds

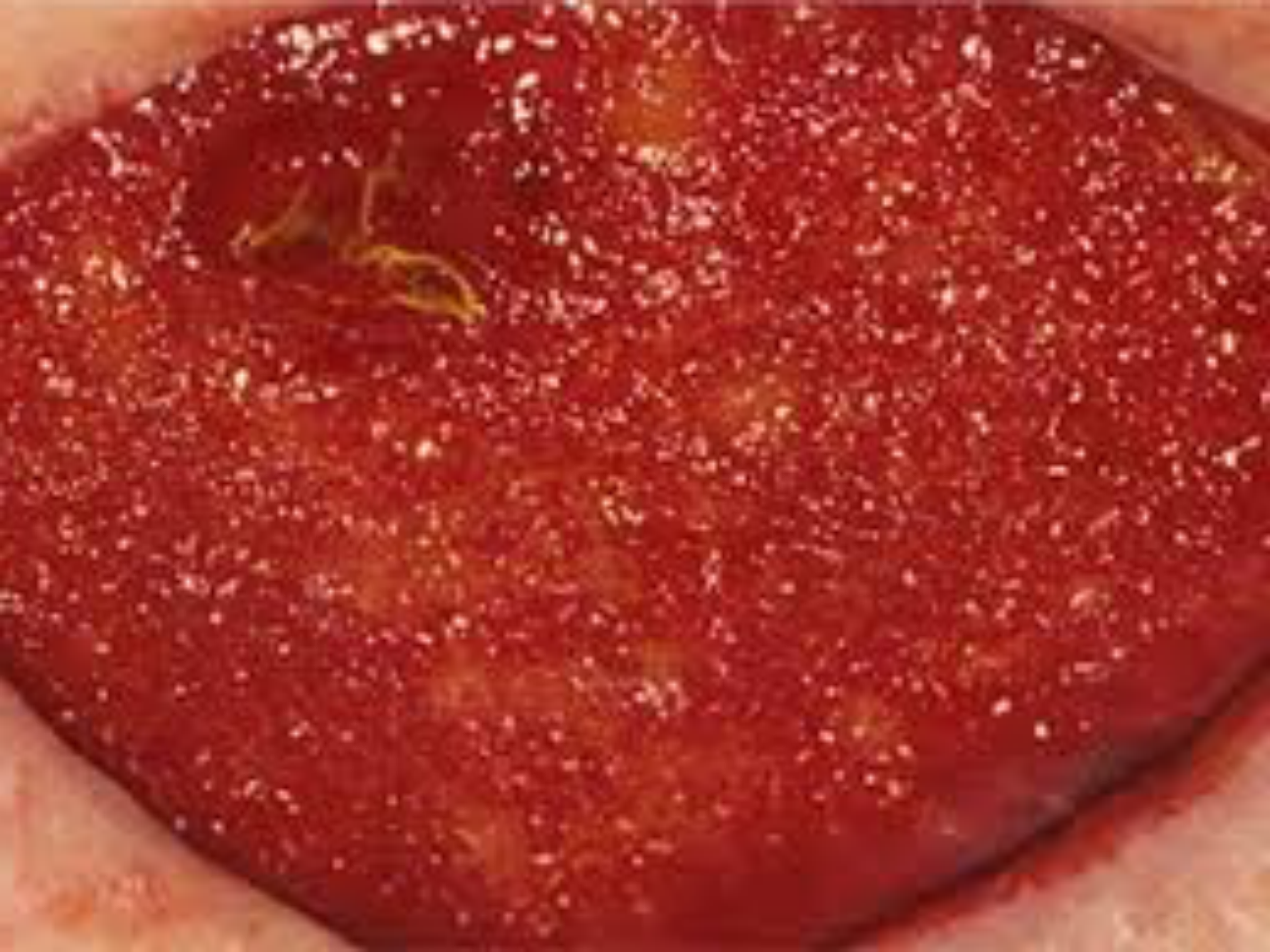
Invasion of wound tissue by and multiplication of pathogenic microorganisms, which may produce subsequent tissue injury and progress to overt disease through a variety of cellular or toxic mechanisms

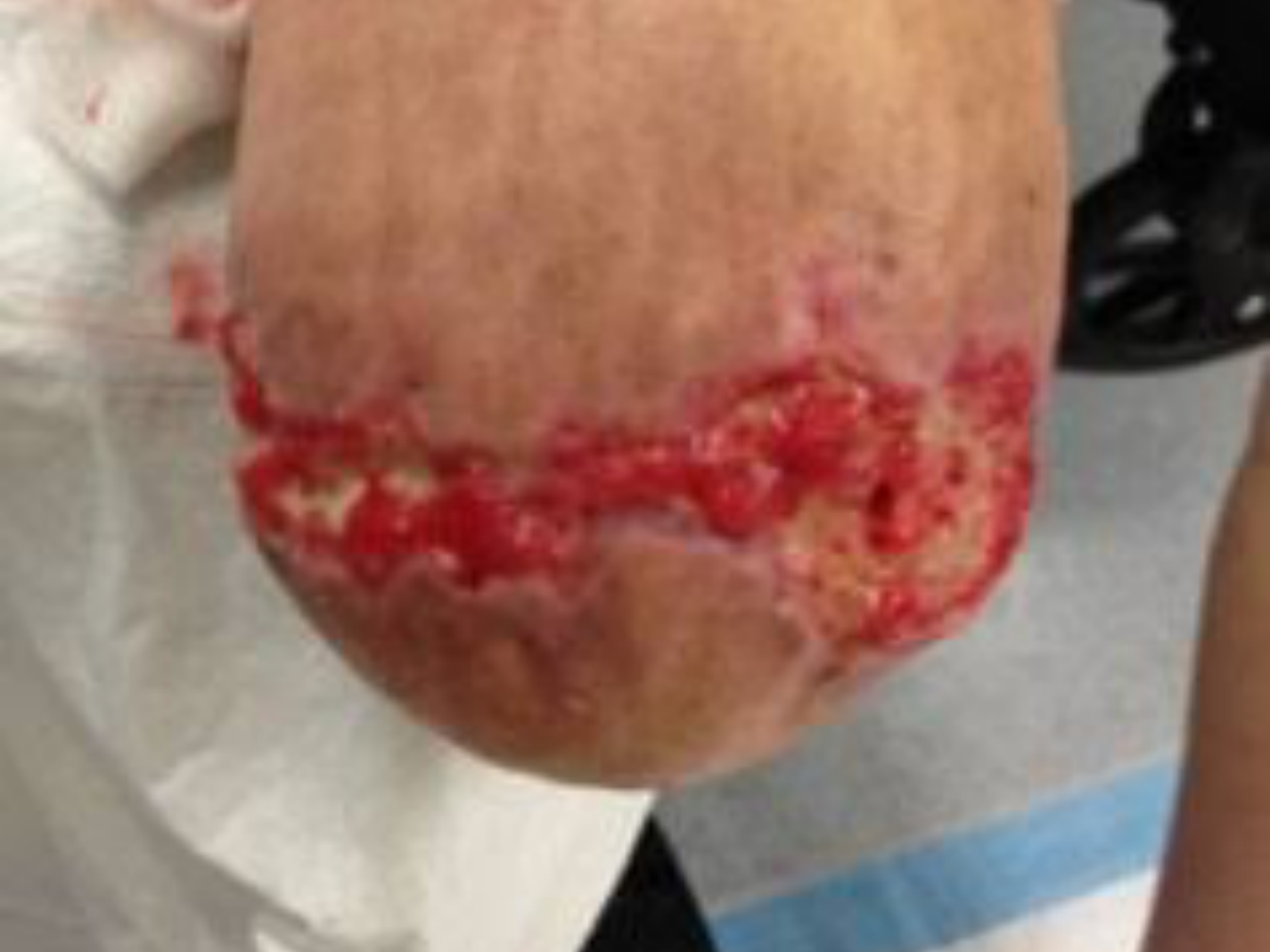


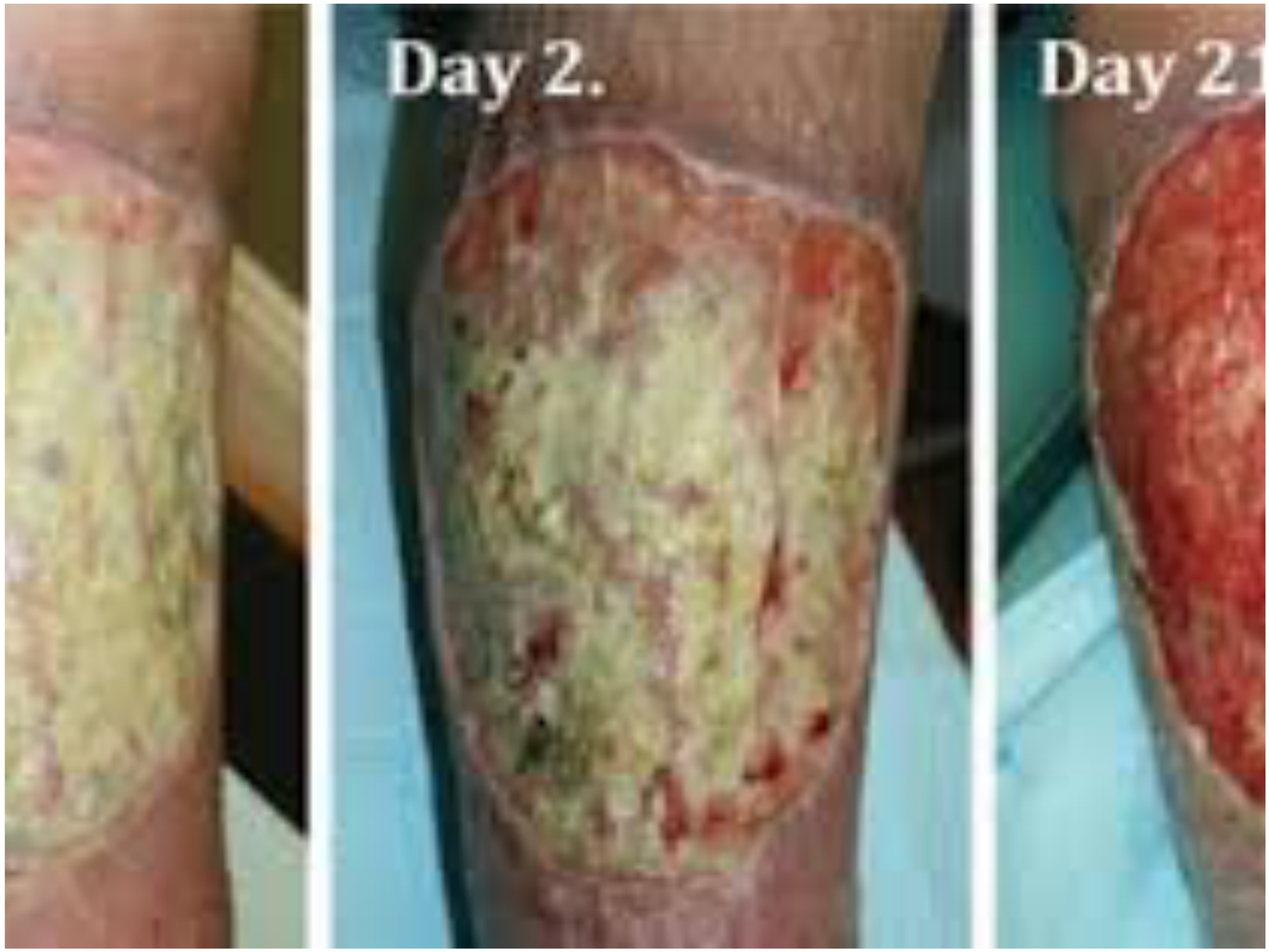


Wound Bed

- Granulating: healthy red tissue which is deposited during the repair process, presents as pinkish/red coloured moist tissue and comprises of newly formed collagen, elastin and capillary networks. The tissue is well vascularised and bleeds easily
- Epithelializing: process by which the wound surface is covered by new epithelium, this begins when the wound has filled with granulation tissue. The tissue is pink, almost white, and only occurs on top of healthy granulation tissue
- Sloughy: the presence of devitalized yellowish tissue. Is formed by an accumulation of dead cells. Must not be confused with pus
- Necrotic: wound containing dead tissue. It may appear hard dry and black. Dead connective tissue may appear grey. The presence of dead tissue in a wound prevents healing
- Hypergranulating; granulation tissue grows above the wound margin. This occurs when the proliferative phase of healing is prolonged usually as a result of bacterial imbalance or irritant forces



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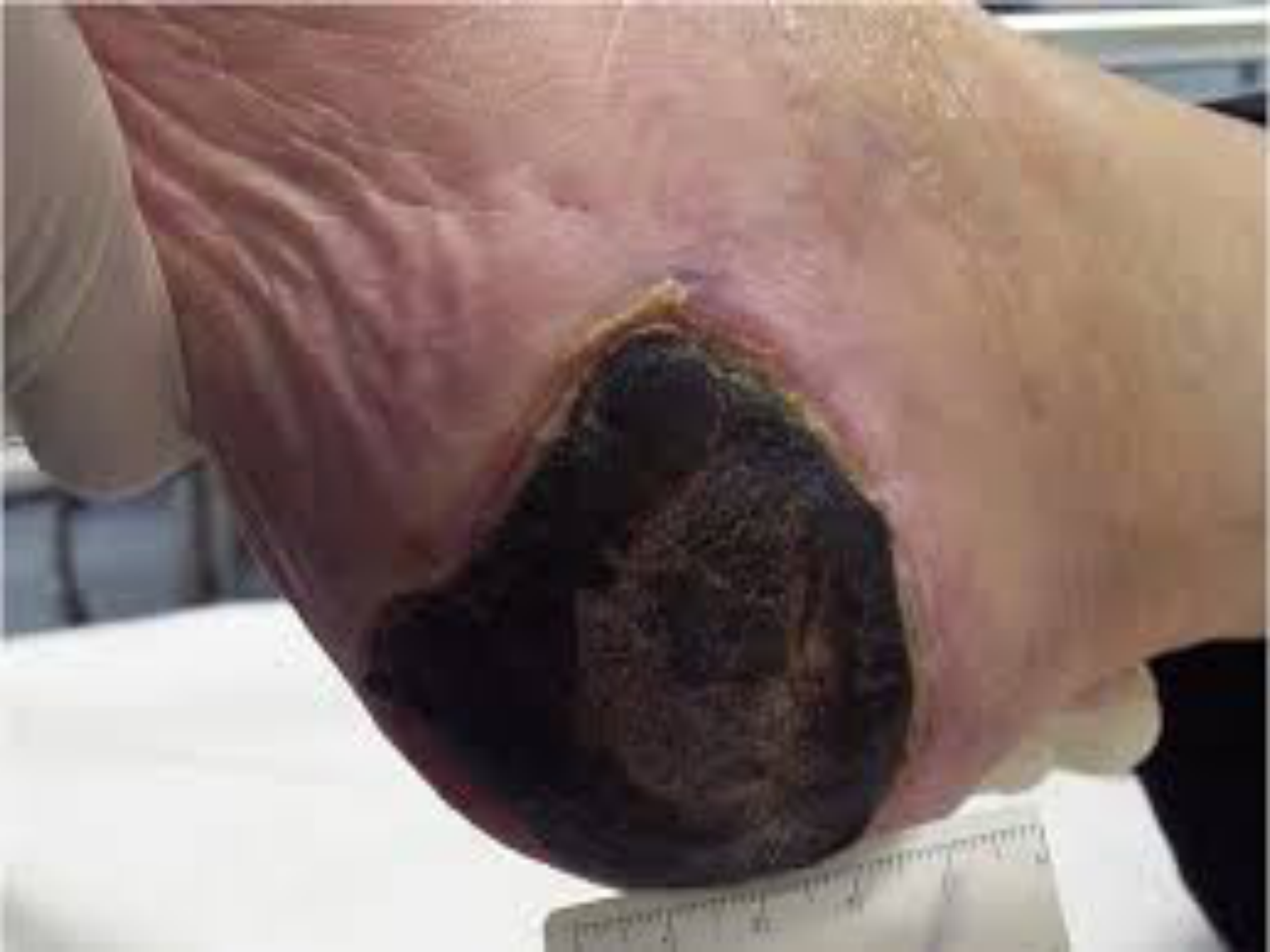
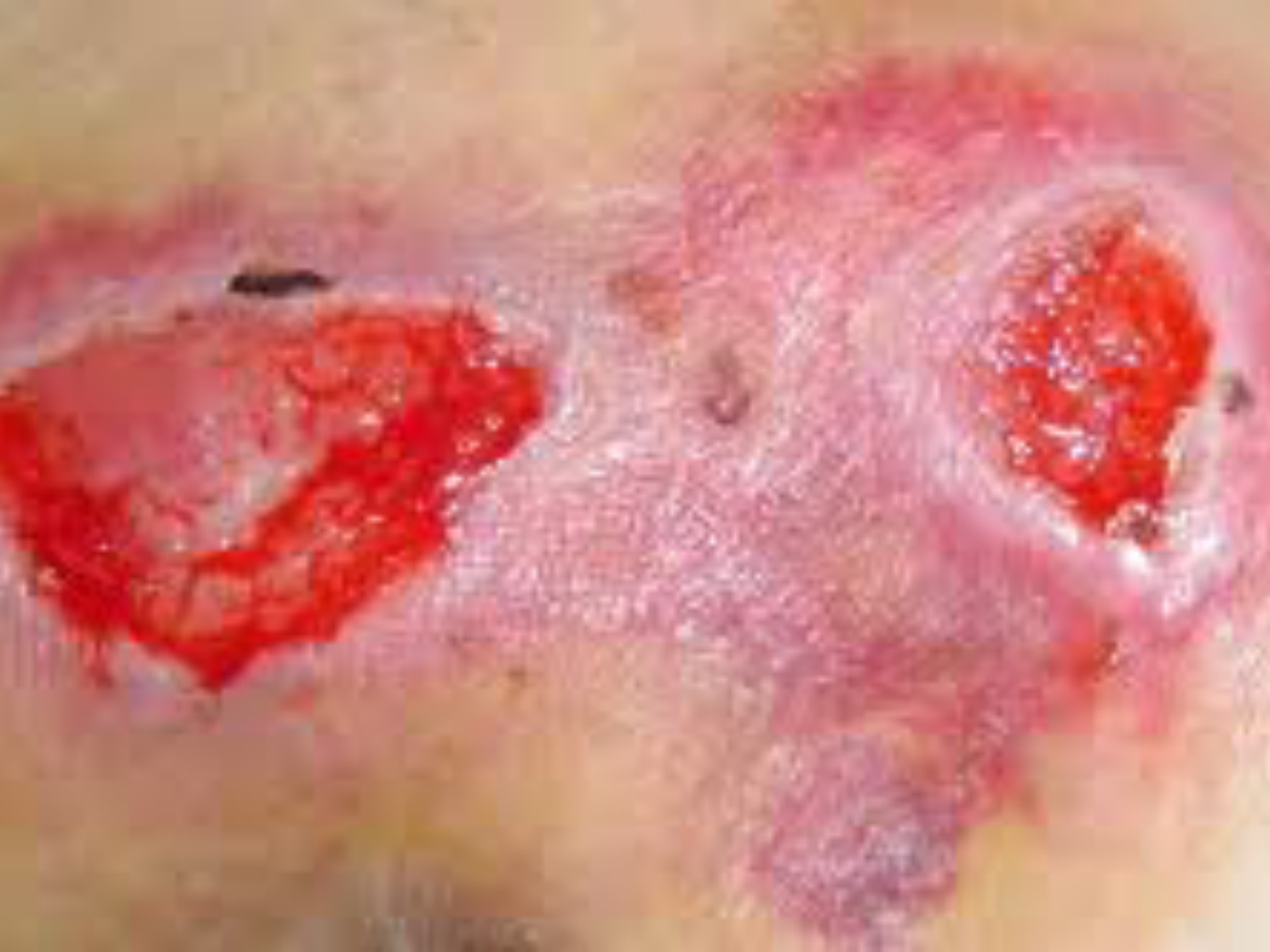




Wound Measurement

- 'Assessment and evaluation of the healing rate and treatment modalities are important components of wound care. All wounds require a two-dimensional assessment of the wound opening and a three-dimensional assessment of any cavity or tracking' (Carville, K. 2007)
- **Two-dimensional measures**- use a paper tape to measure the length and width in millimetres. The circumference of the wound is traced if the wound edges are not even - often required for chronic wounds. (You may also consider photography)
- **Three -dimensional measures**- the wound depth is measured using a dampened cotton tip applicator

■ Wound Measuring Guide

DIAMETER in CM

PATIENT'S NAME

Exudate

- Is produced by all acute and chronic wounds (to a greater or lesser extent) as part of the natural healing process.

It plays an essential part in the healing process in that it:

  - Contains nutrients, energy and growth factors for metabolising cells
  - Contains high quantities of white blood cells
  - Cleanses the wound
  - Maintains a moist environment
  - Promotes epithelialisation
-

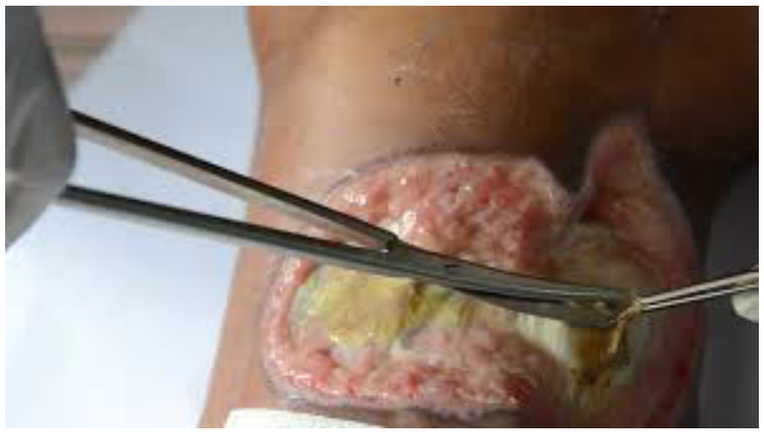
It is important to asses and document the

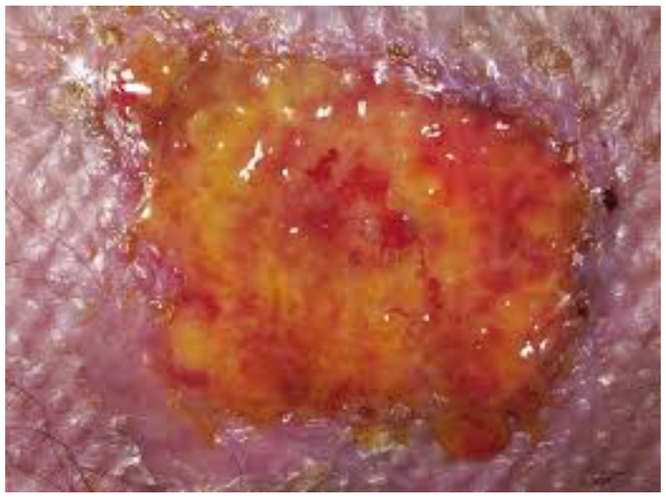
type,
amount
and odour of exudate to identify any changes.

- Too much exudate leads to maceration and degradation of skin while too little can result in the wound bed drying out.

It may become more viscous and odorous in infected wounds.

Type	Colour	Consistency	Significance
Serous	Clear, straw coloured	Thin, watery	Normal. An increase may be indicative of infection
Haemoserous	Clear, pink	Thin, watery	Normal
Sanguinous	Red	Thin, watery	Trauma to blood vessels
Purulent	Yellow, grey, green	Thick	Infection. Contains pyogenic organisms and other inflammatory cells





Infection

- Wound infection may be defined as the presence of bacteria or other organisms, which lead to a host reaction. A host reaction can present with one or a combination of the following local and systemic **clinical indicators:**
- Local indicators
  - Redness (erythema or cellulitis) around the wound
  - Increased amounts of exudate
  - Change in exudates colour
  - Malodour
  - Localised pain
  - Localised heat
  - Delayed or abnormal healing
  - Wound breakdown
- Systemic indicators
  - Increased systemic temperature
  - General malaise
  - Increased leucocyte count
  - Lymphangitis
- If any of the above clinical indicators are present medical review should be instigated and an Microscopy & Culture Wound Swab (MCS) should be considered

Surrounding Skin

- Surrounding tissue may present as
  - Healthy
  - Macerated
  - Dry/flaky
  - Eczematous
  - Black/blue discoloration
  - Fragile
  - Oedema
  - Erythema
  - Induration (hardening)
  - Cellulitis
- The surrounding skin should be examined carefully as part of the process of assessment and appropriate action taken

Pain

- The pain associated with chronic wounds can be underestimated. It is important that pain scores are captured accurately and regularly to ensure
  - patients have a more active role in dealing with their pain
  - effective pain relief can be provided
  - documented evidence of pain patterns are captured

impairment	Bacterial activity	
Contaminiation	Bacteria are on the wound surface. No division is occurring	No impairment to healing No obvious clinical signs of infection
Colonisation	Bacteria are dividing	No impairment to healing No obvious clinical signs of infection
Topical infection (Critical colonisation)	Bacteria are dividing and have invaded the wound surface There may be an increasing variety of bacteria present Biofilm may be present	Impairment to healing Clinical signs of infection may not be obvious or are subtle; dull wound tissue, absence of vibrant granulation tissue, slough, hypergranulation, rolled or raised wound edges
Local infection	Bacteria and / or their products have invaded the local tissue	Impairment to healing Usually obvious signs of infection localised to the wound environment; wound breakdown, increase in size, erythema, increased pain, purulent or discoloured exudate, malodour and increased temperature at wound site
Regional / Spreading infection / Cellulitis	Bacteria and / or their products have invaded the surrounding tissue	Impairment to healing Usually obvious signs of infection. May have systemic signs; spreading erythema (more than 2cm from wound edge), induration of regional tissue, fever, oedema of regional tissue, malaise and/or general feeling of unwellness
Sepsis	Bacteria and / or their products have entered the blood stream and may have spread to distant sites or organs	Impairment to healing Usually obvoius systemic clinical signs; patient acutely unwell, damage to organs may occur, high fever, lymphangitis and regional lymphadenopathy, organ compromise or failure and possibly circulatory shock (including hypotension, tachypnoea, tachcardia)

WOUND HEALING

Phases of Wound Healing to consider

- **Phase 1 - INFLAMMATORY PHASE (0-3 Days**) the body's normal response to injury. This phase activates vasodilatation leading to increased blood flow causing HEAT, REDNESS, PAIN, SWELLING, LOSS OF FUNCTION (e.g. arm swells and cannot bend). Wound ooze may be present and this is also a normal body response.

- **Phase 2 - PROLIFERATIVE PHASE (3-24 Days)** the time when the wound is healing. The body makes new blood vessels, which cover the surface of the wound. This phase includes reconstruction and epithelialisation. The wound will become smaller as it heals.

- **Phase 3 - MATURATION PHASE (24-365 Days)** the final phase of healing, when scar tissue is formed. The wound at this stage is still at risk and should be protected where possible.

Mechanisms of wound healing to consider

- **Primary Intention**; most clean surgical wounds and recent traumatic injuries are managed by primary closure. The edges of the wounds are approximated with steri strips, glue, sutures and/or staples. Minimal loss of tissue and scarring results.

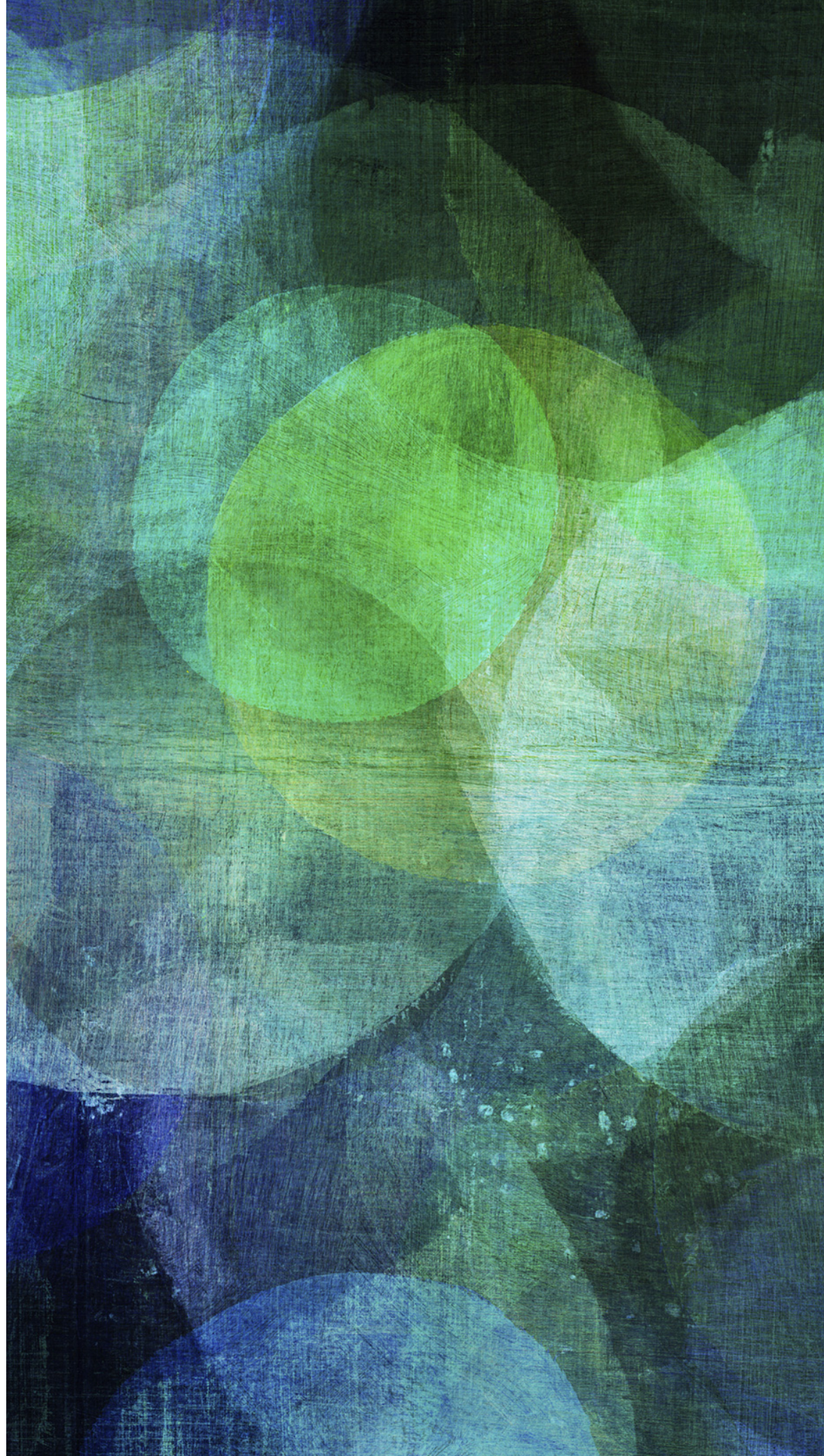
- **Delayed Primary Intention;** is defined as the surgical closure of a wound 3 -5 days after the thorough cleansing or debridement of the wound bed. Used for 1. Traumatic wounds, 2. Contaminated surgical wounds.

- **Secondary intention;** occurs slowly by granulation, contraction and re-epithelialisation and results in scar formation. Commonly used for 1. Pressure Injuries 2. Leg ulcers 3. Dehisced wounds

- **Skin Graft;** removal of partial or full thickness segment of epidermis and dermis from its blood supply and transplanting it to another site to speed up healing and reduce the risk of infection.

- **Flap;** is a surgical relocation of skin and underlying structures to repair a wound

WOUND CLENSING



Wound cleansing

Requires the application of fluid to clean the wound and optimise the healing environment.
The goal of wound cleansing is to:

- Remove visible debris and devitalised tissue
- Remove dressing residue
- Remove excessive or dry crusting exudates

Principles:

- Use Aseptic Technique procedure
- Wound cleansing should not be undertaken to remove 'normal' exudate
- Cleansing should be performed in a way that minimises trauma to the wound
- Wounds are best cleansed with sterile isotonic saline or water
- The less we disturb a wound during dressing changes the lower the interference to healing
- Fluids should be warmed to 37°C to support cellular activity
- Skin and wound cleansers should have a neutral pH and be non-toxic
- Avoid alkaline soap on intact skin as the skin pH is altered, resistance to bacteria decreases
- Avoid delipidising agents as alcohol or acetone as tissue is degraded
- **Antiseptics are** not routinely recommended for cleansing and should only be used sparingly for infected wounds

Method:

- Irrigation is the preferred method for cleansing open wounds. This may be carried out utilising a syringe in order to produce gentle pressure - in order to loosen debris. Gauze swabs and cotton wool should be used with caution as can cause mechanical damage to new tissue and the shedding of fibres from gauze swabs/cotton wool delays healing.

Choice of dressing

A wound will require different management and treatment at various stages of healing. No dressing is suitable for all wounds; therefore frequent assessment of the wound is required. Considerations when choosing dressing products -

- Maintain a moist environment at the wound/dressing interface
- Be able to control (remove) excess exudates. A moist wound environment is good, a wet environment is not beneficial
- Not stick to the wound, shed fibres or cause trauma to the wound or surrounding tissue on removal
- Protect the wound from the outside environment - bacterial barrier
- Good adhesion to skin
-

- Sterile
  - Aid debridement if there is necrotic or sloughy tissue in the wound (caution with ischaemic lesions)
  - Keep the wound close to normal body temperature
  - Conformable to body parts and doesn't interfere with body function
  - Be cost-effective
  - Diabetes - choose dressings which allow frequent inspection
  - Non-flammable and non-toxic

Dressings can be catagorized into four types:

1 Primary dressing: is one that comes directly in contact with the wound bed

2 Secondary dressing:is used to cover a primary dressing when the primary dressing does not protect the wound from contamination

3 Occlusive dressing: covers a wound from the outside environment and keep nearly all wound vapours at the wound site

4 Semi-occlusive dressing: allows some oxygen and moisture vapour to evaporate

MODE OF ACTION OF DRESSINGS

At a basic level, many dressings handle fluid by absorbing it and/or allowing it to evaporate. In addition, properties such as fluid retention and sequestration may be considered.

- *Absorption – Fluid enters dressing materials by diffusion and by being drawn into spaces*

(capillary action or 'wicking'). Simple absorptive dressings, eg foams and cotton, viscose or polyester textiles, hold fluid within spaces in their structure like a sponge. When these materials are placed under pressure, fluid is released from the spaces and may leak from the dressing.

■ *Evaporation/transmission – Many absorbent dressings also allow moisture to evaporate from the surface of the dressing. This characteristic is quantified as the moisture vapour transmission rate (MVTR).*

Semi-permeable films are not absorbent, and although impermeable to fluid and bacteria, allow water vapour to evaporate. Some films have a low MVTR, which may result in maceration from fluid held under the dressing.

Dressings with a very high MVTR may be useful in managing exudate where minimal bulk is preferable, eg in malignant wounds on the face.

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■ *Fluid retention – Interactive dressings, eg hydrocolloids, alginates and carboxymethylcellulose (CMC) fibres (Hydrofiber® dressings), take up liquid to form a gel.*

When placed under pressure, the gel changes shape but retains the fluid. Materials that form uniform cohesive gels are generally more likely to stay intact during use and may reduce lateral tracking of fluid and the risk of periwound maceration.

This is particularly useful under compression.

Synthetic fibre gauze

Topper

Only use on minor wounds or as secondary dressings

More absorbent than cotton. Do not shed fibres

Advantages

Often sticks to wound surface and disrupts wound bed when removed.

Disadvantages

Creates a dry wound

Contraindications

Moderate to heavily exudating wounds

➤

Island dressings

Primapore Mepore
Opsite post op Compose

slightly absorbant non-adherent pad with an adhesive cover

Acute surgical incisions.
Wounds healing by primary intention or low exudating wounds

Advantages

Absorbs excess wound fluid, maintain a sterile environement and provides a protective barrier

Disadvantages

Unable to absorb high amounts of exudates
Removal may cause trauma to surrounding tissue

Contraindications

Moderate to highly exudating wounds

➤

OpSite, Tegaderm

Semi- permeable

Thin, adhesive, transparent polyurethrane film

Superficial wounds.As a secondary dressing.

Advantages

Some moisture evaporation, Reduces pain. Barrier to external contamination. Allows inspection.

Disadvantages

Exudate may pool, may be traumatic to remove.

Contraindications

Moderate to high exudative wounds.

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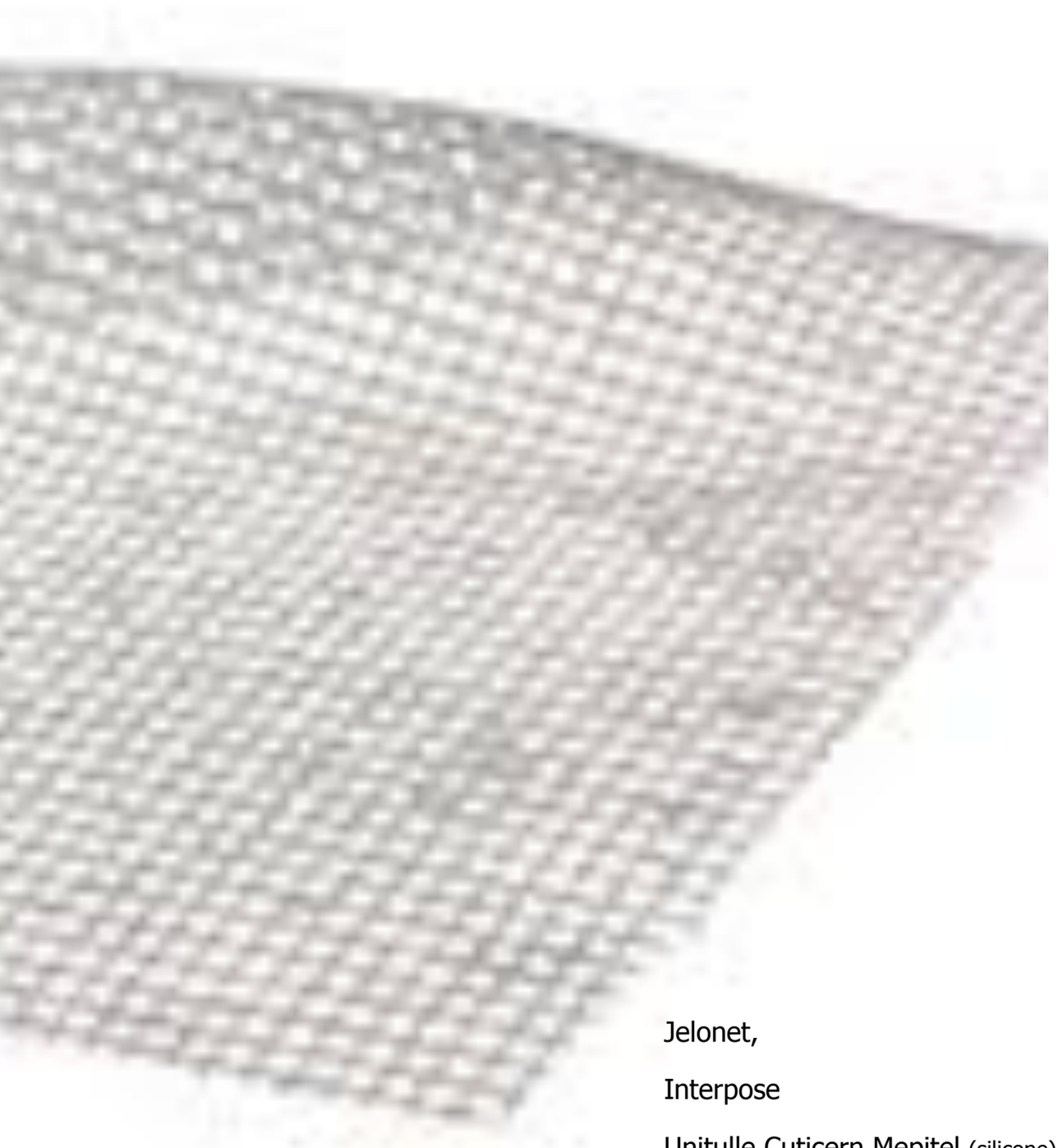

Jelonet,

Interpose

Unitulle Cuticern Mepitel (silicone)

Non adherent Moist

(Tulle Gras Dressing) – Gauze impregnated with paraffin or similar.

Wounds healing by secondary intention, superficial clean wounds

Advantages

Reduces adhesion to wound. Moist environment aids healing.

Disadvantages

Does not absorb exudate. Requires secondary dressing. May promote hypergranulation

Contraindications

Allergy to paraffin products
Allergy to silicone products

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Non adherent Moist for contaminated wounds

Gauze impregnated with antiseptics or antibiotics

Burns. Contaminated or infected wounds

Advantages

Reduces adhesion to wound. Moist environment aids healing. Antiseptic therapy in contaminated or infected wounds

Disadvantages

Does not absorb exudate.Requires secondary dressing May induce allergy or delay healing when impregnated

Contraindications

Allergy

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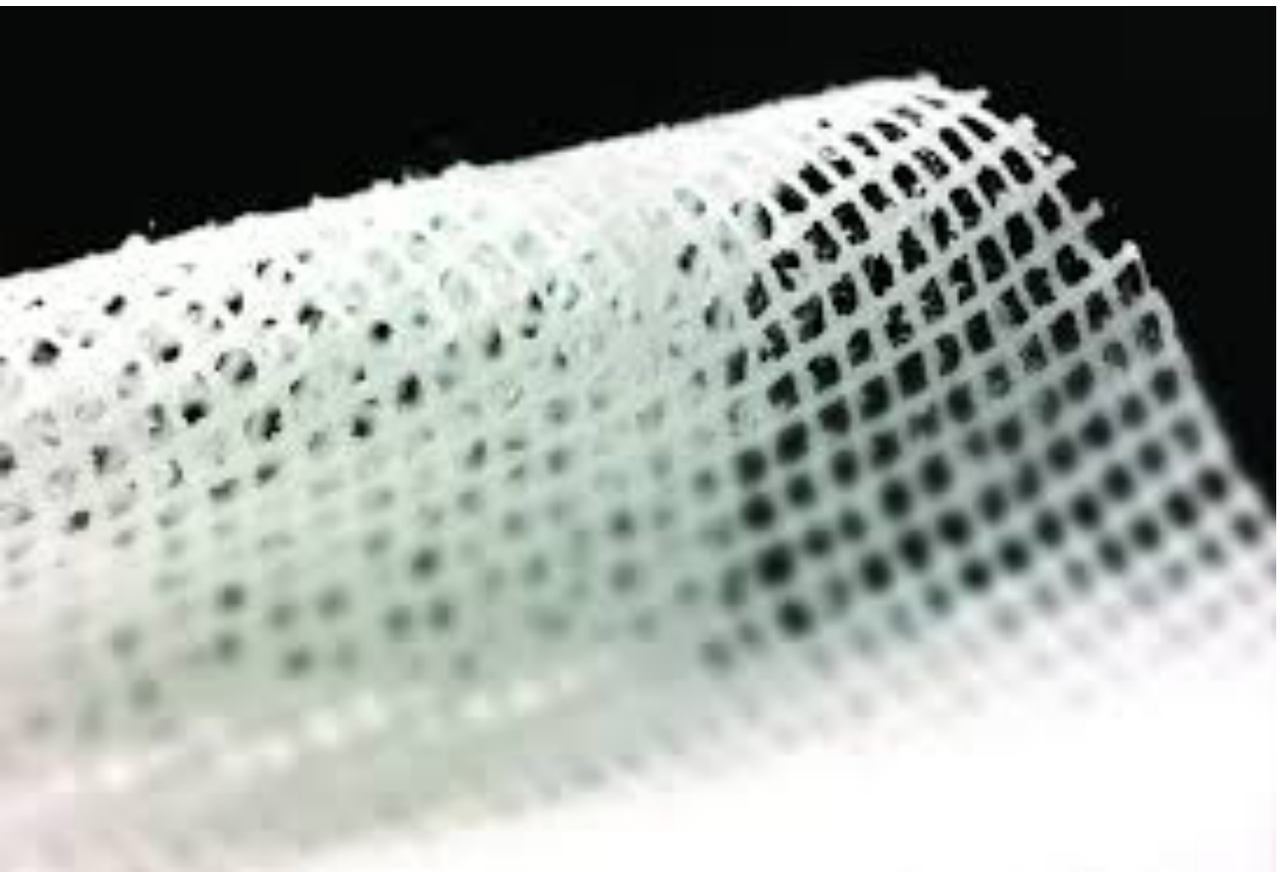

Bactigras Xeroform

Non adherent Dry

Melolin Melolite Tricose Exu-dry Mesorb

Thin perforated plastic film coating attached to absorbent pad

Wounds with moderate exudates Epidermal wounds or wounds healing by primary intention

Advantages

Low wound adherence.
May absorb light exudate.

Disadvantages

Not suitable in high exudate (except exu-dry & mesorb). Can dry out and stick to wound. May require secondary dressing

Containdications

Dry wounds (may cause tissue dehydration)

➤

Calcium Alginate.

Kaltostat Sorbsan, AlgiSite M

Natural polysaccharide from seaweed

Moderate to high exuding wounds and for wounds with minor bleeding.

Chronic wounds: leg ulcers, pressure ulcers, diabetic ulcers
Acute wounds: donor sites, abrasions

Forms gel on wound keeping environment moist. Reduces pain.

Advantages

Packs cavities. Absorbent in exudative wounds. Haemostasis.

Disadvantages

May require secondary dressing.
Gel can be confused with slough or pus in wound.

Containdications

Kaltostat not suitable for use in infants less than 12 months
Dry wounds or hard eschar
Sensitivity

➤

Allevyn

Hydrasorb Mepilex Mepilex border

Allevyn cavity

FOAM

Polyurethane foam dressing, some with adhesive layer incorporated

Moist wound.enviroment, highly absorbent and protective Permeable to oxygen and water vapour

Advantages

Wounds with mild to moderate exudate.

Disadvantages

Will not debride hard exudate

Contraindications

Dry wounds.

Necrotic wounds or hard eschar.

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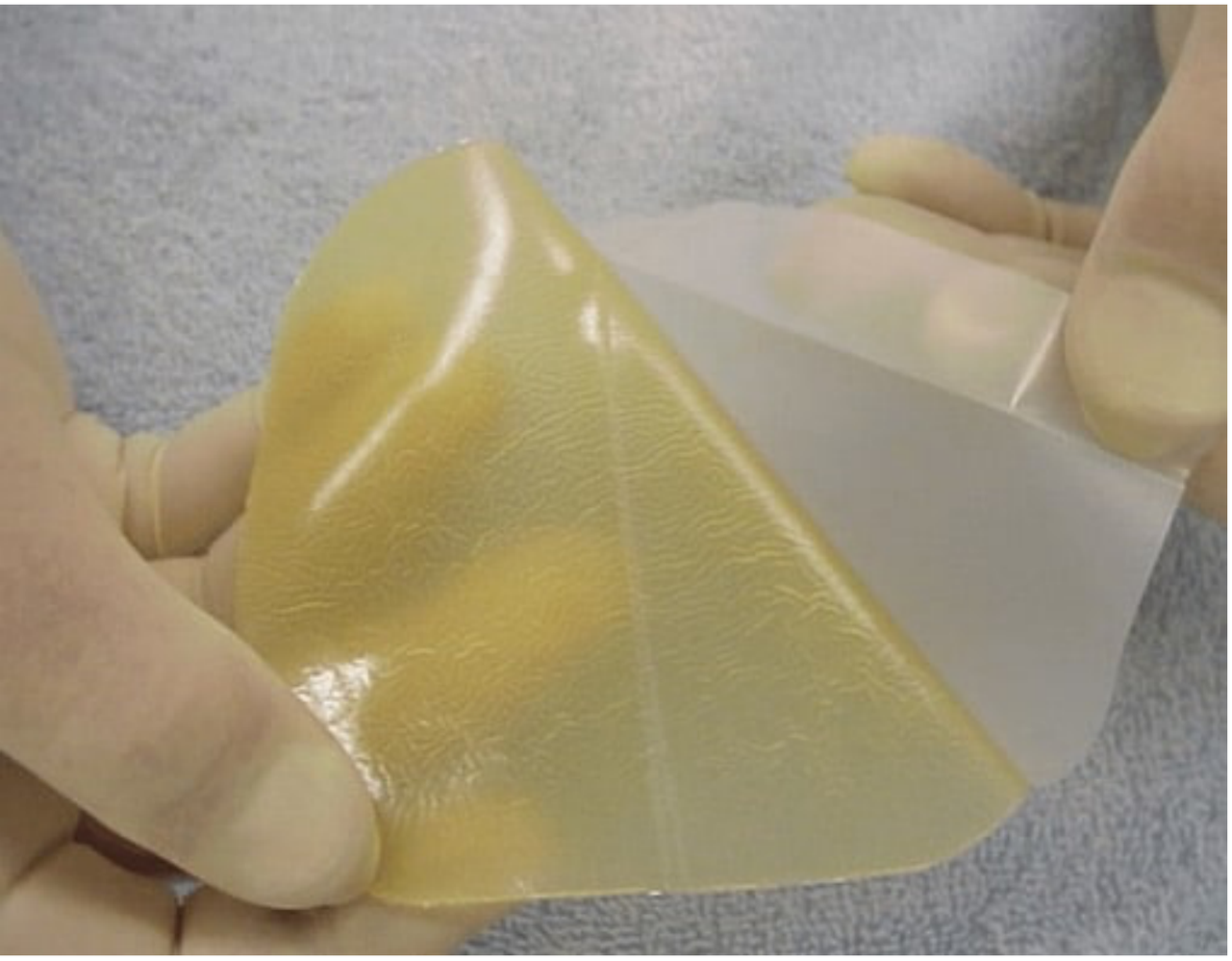
Hydrocolloid



Duoderm Comfeel Coloplast sheet

Polyurethane film coated with adhesive mass

Burns (small)Abrasions

Advantages

Waterproof. Conforms well to wound.
Gel formation provides moist wound enviroment

Disadvantages

Avoid on high exudate wounds Gel mistaken for wound infection

Contraindications

Dirty wounds Infection
Wounds where muscle, tendon or, bone exposed

If wound requires frequent changes

➤

Hydrogel

Composed mainly of water in a complex network or fibres that keep the polymer gel intact. Water is released to keep the wound moist

Indications

Necrotic or sloughy wound

Advantages

Creates optimal moist environment rehydrating wound bed and removing dead tissue. Reduces wound pain. Conforms to wound.

Disadvantages

Potential to macerate surrounding tissue Requires additional secondary dressing to secure

Contraindications

Moderate to heavily exudating wounds

Alllergy
Superficial wounds

Aquacel

Hydrofibre

Soft non-woven pad or ribbon dressing made from sodium carboxymethylcellulose fibres

Lesions and cavity wounds acute and chronic
Wounds healing by secondary intention

Advantages

Interact with wound drainage to form a soft gel
Absorbs exudate. Provides a moist environment

Disadvantages

Secondary dressing needed

Contraindications

Dry and necrotic wounds

➤

Hypertonic saline impregnated -

infused with sodium chloride

Hypergel Mesalt

Wounds with excessive exudate.

Moist necrotic , draining and infected wounds

Wicks moisture away from wounds. Promotes autolysis, reduces odour.

May dry the wound out too much.
May cause stinging/ discomfort

Bleeding wounds or exposed tendon, bone or muscle

➤

COLLAGEN

- Biological dressings
- Bovine dermis
- Burns

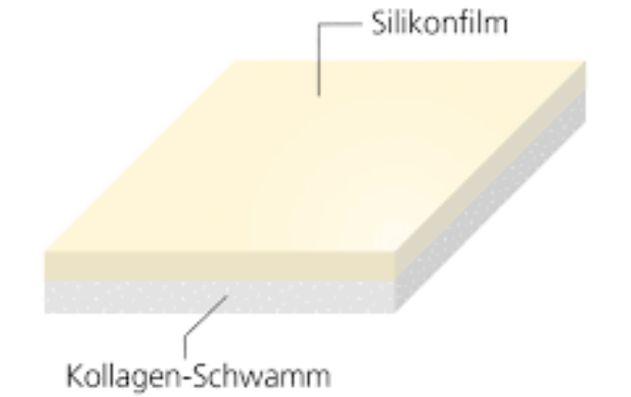
CADAVERIC SKIN

- Processed skin
- Provided by skin bank
- Cryo preserved
- Glyceropreserved
-

LIVE DONOR SKIN

- Mother to neonate

ARTIFICIAL SKIN



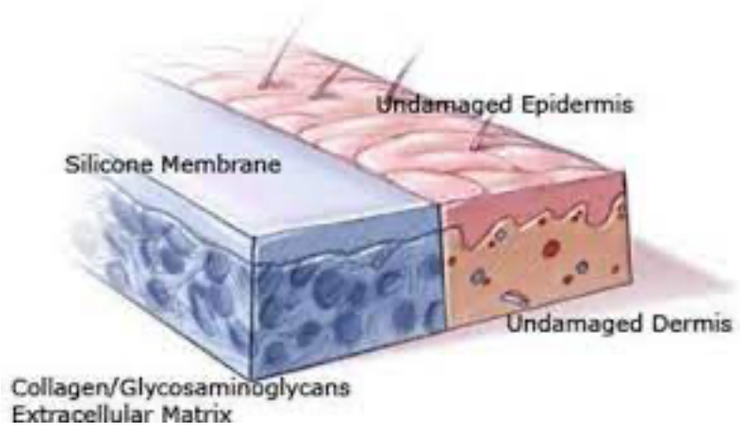
REF PN-R40030

Dermal Regeneration Template is a two-layer skin regeneration system.

The outer layer is made of a thin silicone film that acts as your skin's epidermis.

It protects the wound from infection and controls both heat and moisture loss.

The inner layer is constructed of a complex matrix of cross-linked fibers.



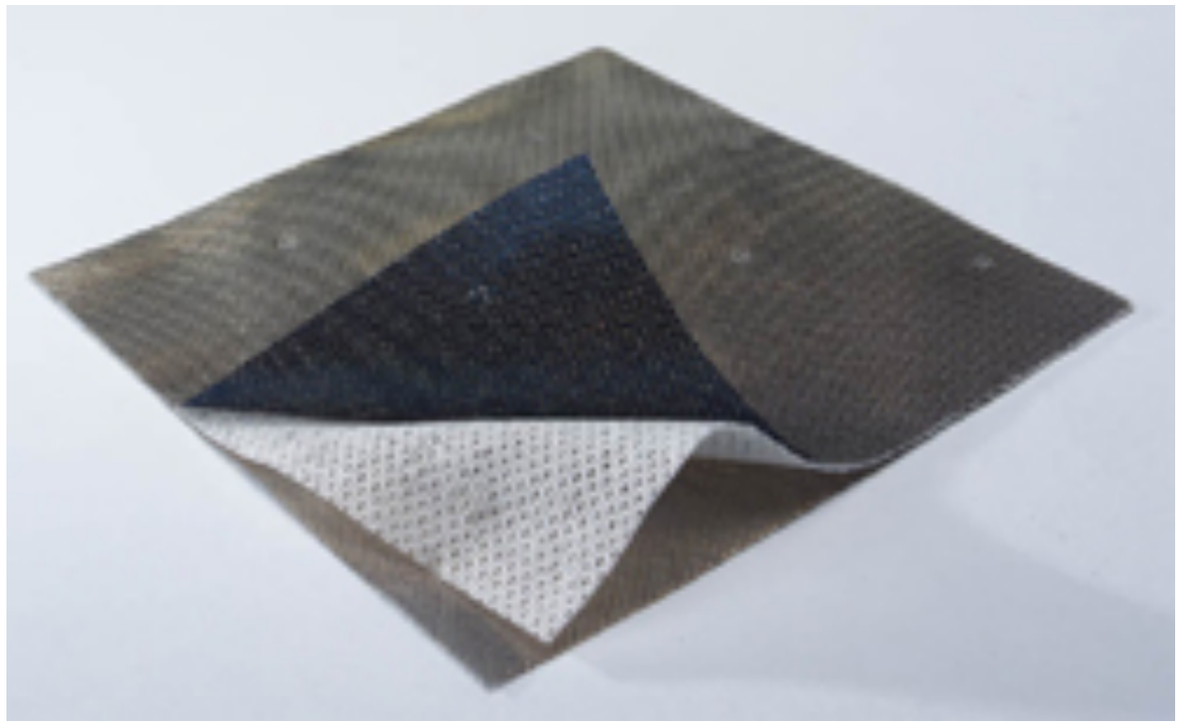
This porous material acts as a scaffold for regenerating dermal skin cells, which enables the re-growth of a functional dermal layer of skin.

Once dermal skin has regenerated, the silicone outer layer is removed and replaced with a thin epidermal skin graft.

SYNTHETIC SKIN

- Biodegradable
- Expensive
- No donor site morbidity
- Can be combined with cell spray

Silver dressings



Dressings containing various doses of silver content

Acticoat Acticoat 7 Aquacel AG Atrauman AG Mepilex AG

Infected wounds Burns

Bacteriocidal – kills pathogens such as MRSA and VRE

Questions remain regarding accumulation toxicity and resistance.

Should be used with care.

Allergy.
Some can’t be used with oil based products or topical antimicrobial

➤

Negative pressure wound therapy

applies suction to wound bed via a computerized therapy unit attached to an open-cell foam sponge placed in the wound and an adhesive drape

Acute and chronic wounds

Promotes localised blood flow,

reduces localised oedema, promotes granulation and epitheliasation
Supports moist wound healing Allows gas exchange

Protect the wound base from environmental contaminants

Requires a power source and specialised dressings

Necrotic eschar, untreated osteomylitis and malignant wounds

➤

Fixation Sheet -

Porous polyester fabric with adhesive backing

Fixomull Hypafix Mefix

Superficial wounds To secure dressings

Conforms to body contours hypoallergenic Can be sterilised without reducing adhesiveness

Requires application of oil prior to removal – ideally soaked in oil and wrapped in cling film overnight.

Infected wounds allergy to adhesives

➤

COTTON CRAPE BANDAGE

It is made of cotton material.

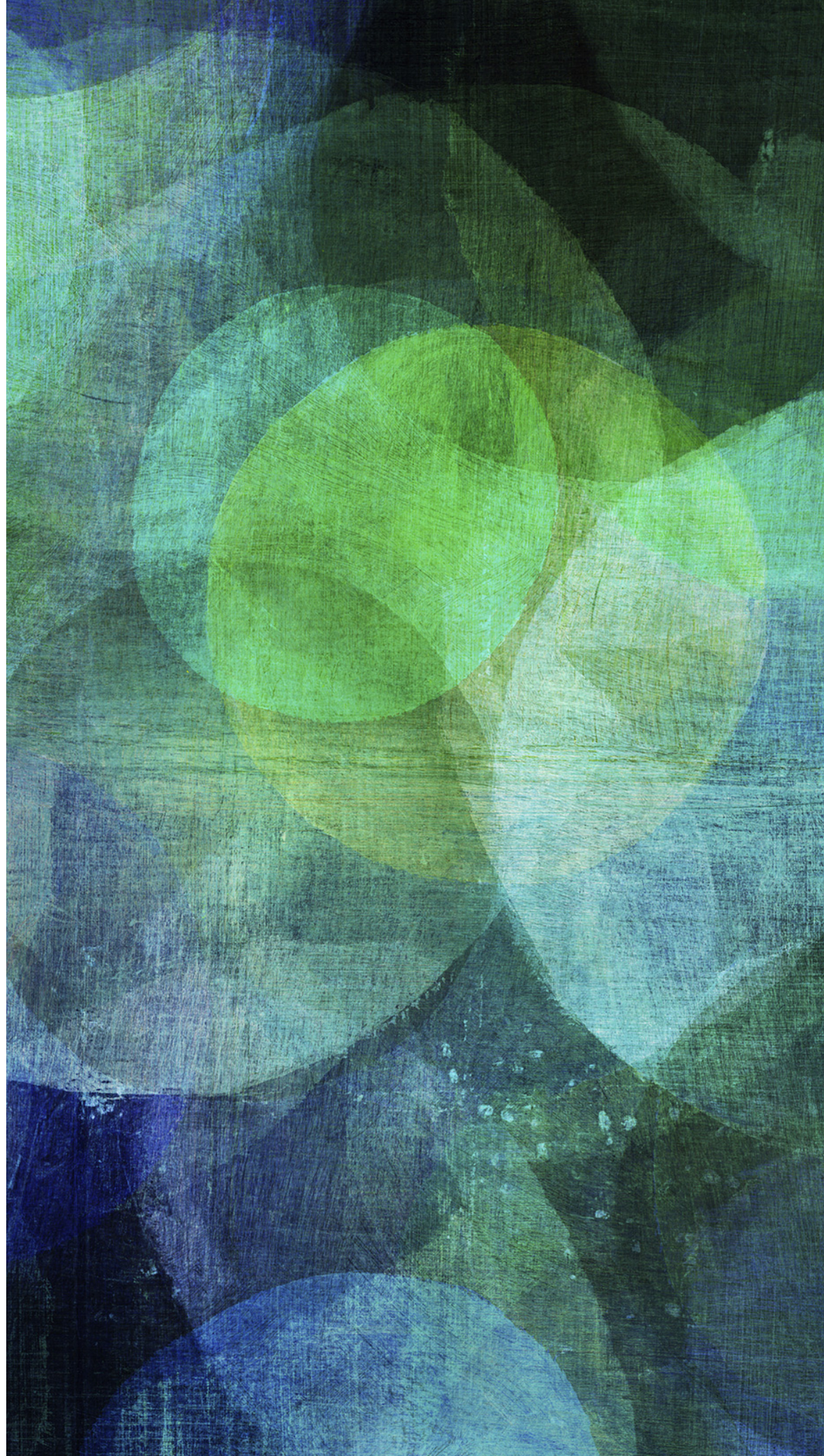
It is highly elastic,
soft,
comfortable,
latex-free,
permeable to air.

5 cmx4.5 m, 7.5cmx4.5 m, 10 cmx4.5 m, 15 cm x 4.5 m, 20cmx4.5 m.

ELASTICATED CRAPE BANDAGES

Elastic crepe bandages are made of cotton, or spandex (a synthetic fiber, polyether-polyurea copolymer), known to be very elastic

EXUDATE

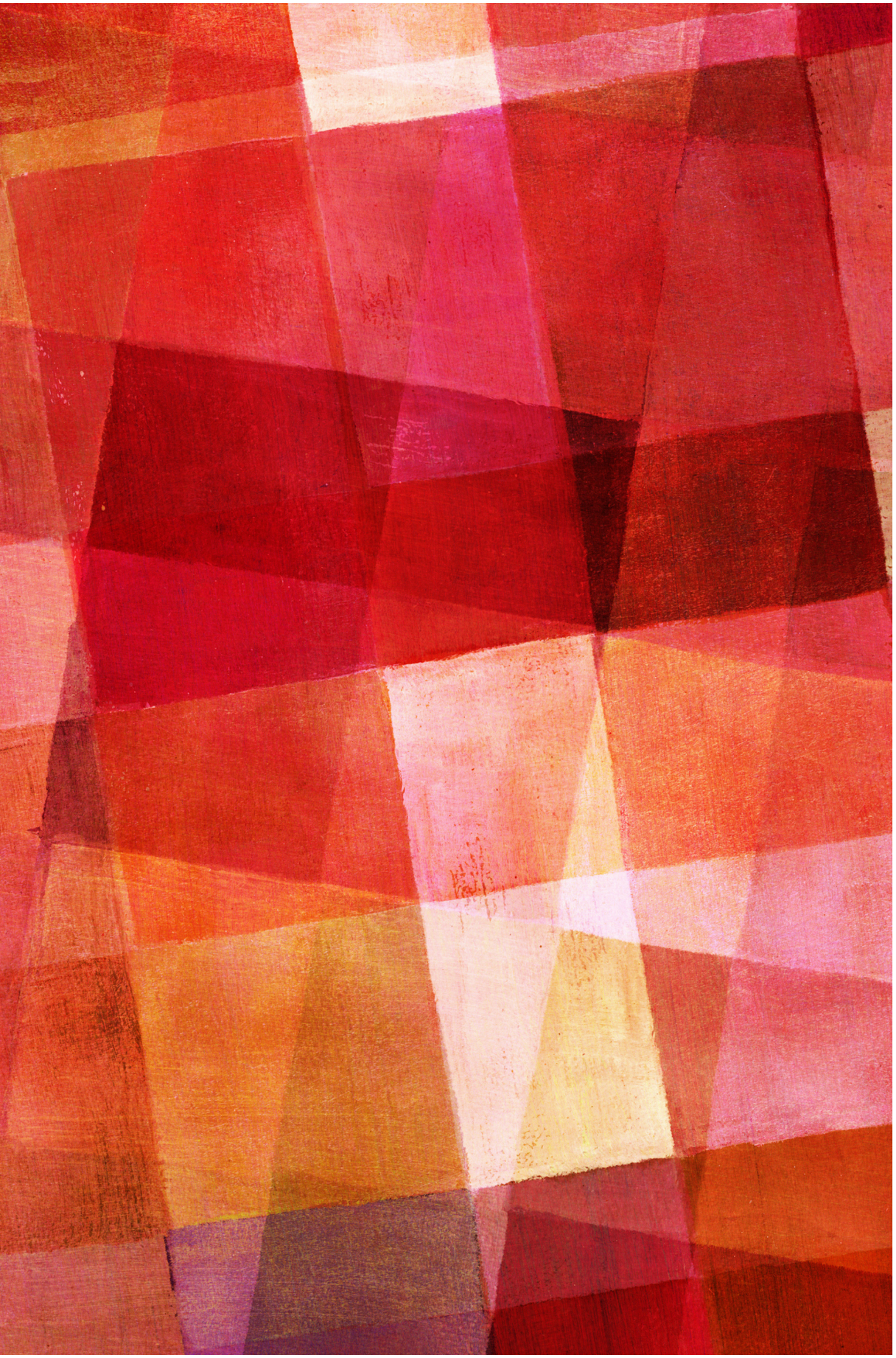


EXUDATE

Clinicians have described wound exudate as ‘what is coming out of the wound’, ‘wound fluid’, ‘wound drainage’ and ‘an excess of normal fluid’. Existing definitions of wound exudate fail to capture its true complexity. What is currently known is that wound exudate is produced in response to a complicated interaction between:

- wound aetiology
- wound healing physiology
- wound environment
- compounding pathological processes.

➤

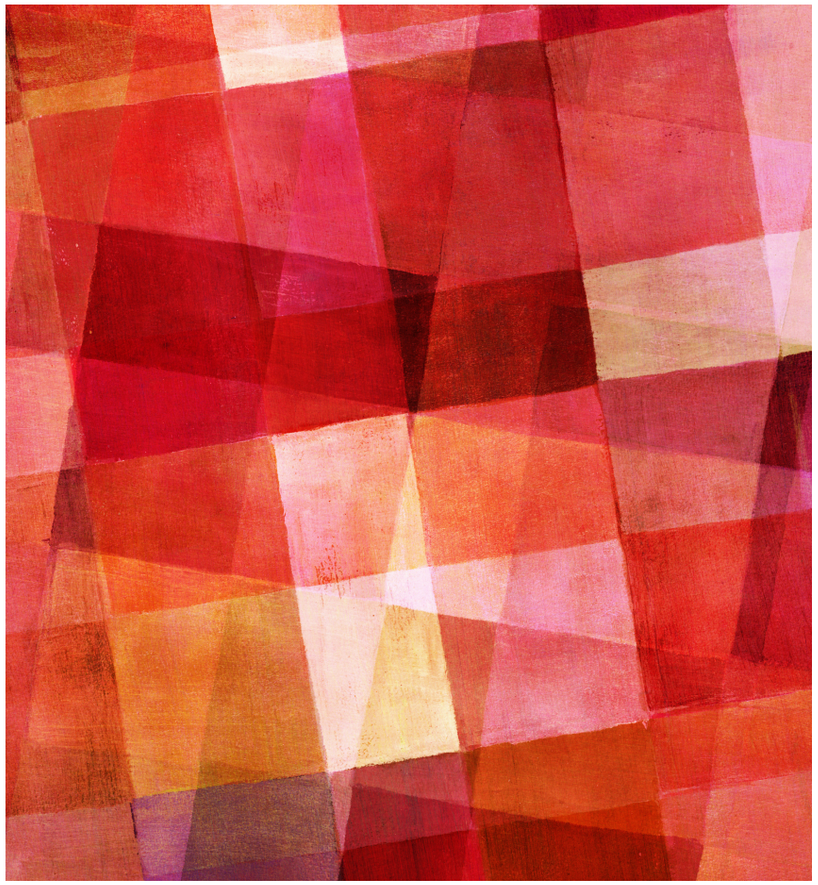


Wound exudate is often misconceived as ‘bad’. In fact, exudate is known to assist healing by:

- preventing the wound bed from drying out
- aiding the migration of tissue-repairing cells
- providing essential nutrients for cell metabolism
- enabling the diffusion of immune and growth factors
- assisting separation of dead or damaged tissue (autolysis).

➤

CHALLENGING MYTHS



‘All exudate is bad’

Although the quantity or composition of exudate may be harmful or delay healing, the theory of moist wound healing emphasises the important role of wound fluid in assisting healing.

‘All increased exudate relates to increased bacterial load or overt infection’

Increased exudate has a wide range of underlying causes. These should be identified and addressed as part of the management plan.

‘A dirty dressing is a useless dressing’

Soiled dressings provide useful information about exudate and the suitability of the dressing for the wound. They can help to inform wound management and dressing selection.

‘All you need is the right dressing to solve problems associated with exudate’

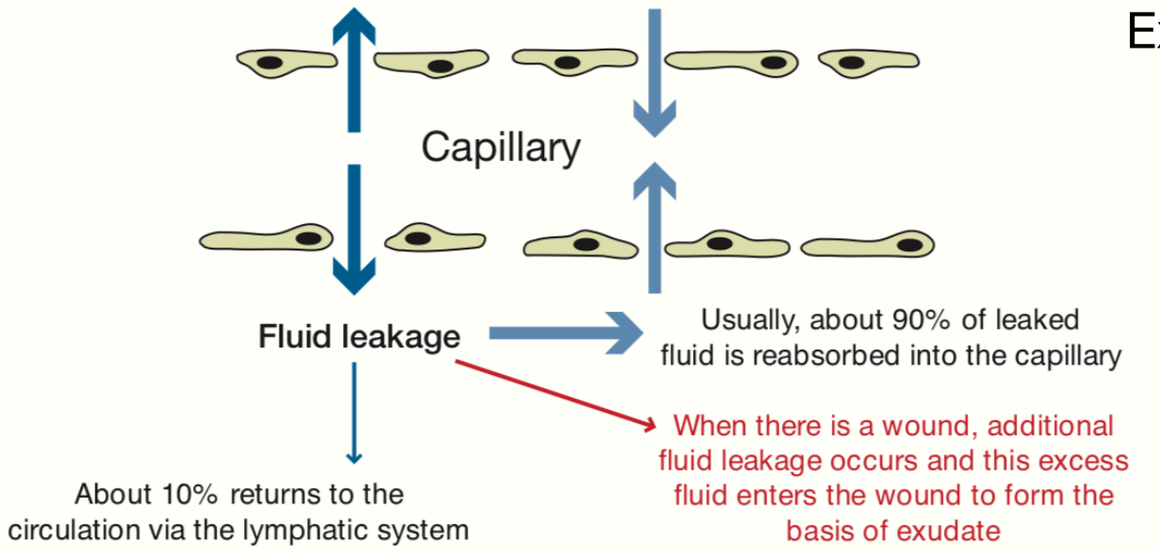
Dressing selection is an important aspect of exudate management. However, treating contributory or underlying factors and modifying the wound environment are also vital.

‘All you need is more padding’

Good management of exudate requires reassessment of the patient and the management plan when strikethrough or leakage continue or worsen.

➤

COMPOSITION OF EXUDATE



Exudate contains a variety of substances including

water,

electrolytes,

nutrients,

inflammatory mediators,

white cells,

protein-digesting enzymes (eg matrix metalloproteinases – MMPs),

growth factors and

waste products.

Significance of exudate colour*

Characteristic	Possible cause
Clear, amber	Serous exudate, often considered 'normal', but may be associated with infection by fibrinolysin-producing bacteria such as *Staphylococcus aureus*; may also be due to fluid from a urinary or lymphatic fistula
Cloudy, milky or creamy	May indicate the presence of fibrin strands (**fibrinous exudate** – a response to inflammation) or infection (**purulent exudate** containing white blood cells and bacteria)
Pink or red	Due to the presence of red blood cells and indicating capillary damage (**sanguineous** or **haemorrhagic exudate**)
Green	May be indicative of bacterial infection, eg *Pseudomonas aeruginosa*
Yellow or brown	May be due to the presence of wound slough or material from an enteric or urinary fistula
Grey or blue	May be related to the use of silver-containing dressings

*NB Some medications are known to discolour urine and consideration could be given to drugs as a cause of exudate discolouration when all other causes have been excluded

Significance of exudate consistency	
High viscosity (thick, sometimes sticky)	■ High protein content due to: – infection – inflammatory process ■ Necrotic material ■ Enteric fistula ■ Residue from some types of dressings or topical preparations
Low viscosity (thin, 'runny')	■ Low protein content due to: – venous or congestive cardiac disease – malnutrition ■ Urinary, lymphatic or joint space fistula

Significance of exudate odour**	
Unpleasant	■ Bacterial growth or infection ■ Necrotic tissue ■ Sinus/enteric or urinary fistula

**NB Some dressings, eg hydrocolloids, may produce a characteristic odour

Significance of high exudate production

In addition to the size of the wound, high levels of or an increase in exudate production may be indicative of underlying disease processes,

High exudate production may have a wide variety of causes. For example, increased exudate production in a patient with a ***chronic venous leg ulcer*** *may be due to:*

- *wound inflammation/infection*
- *longer periods spent with legs in a dependent position*
- *reduced willingness or ability to cooperate with compression therapy*
- *development or deterioration of congestive cardiac failure and peripheral oedema.*

Diagnosing infection or any other underlying disease process relies on full assessment and investigation. Increased exudate production alone is insufficient evidence for a diagnosis.

Factor	Effect on amount of exudate	
	Increased	**Decreased**
Wound healing stage	■ Inflammatory stage of normal wound healing ■ Wounds that are not healing as expected (chronic wounds; sustained inflammatory phase) ■ Autolytic debridement and liquefaction of necrotic tissue	■ Towards the end of the healing processs (ie during proliferation/maturation) ■ Wounds with dry eschar
Local factors	■ Local infection/inflammation/trauma (eg surgical debridement) ■ Foreign body ■ Oedema (eg venous insufficiency/inferior or superior vena caval obstruction/venolymphatic dysfunction/lymphoedema) ■ Sinus or urinary, enteric, lymphatic or joint space fistula	■ Ischaemia
Systemic factors	■ Congestive cardiac, renal or hepatic failure ■ Infection/inflammation ■ Endocrine disease ■ Medication (eg calcium channel blockers, non-steroidal anti-inflammatory drugs (NSAIDs), steroids, glitazones) ■ Obesity/malnutrition	■ Dehydration ■ Hypovolaemic shock ■ Microangiopathy
Practical factors	■ Wound position, eg lower limbs and over pressure areas ■ Heat ■ Reduced willingness or ability to cooperate with pharmacological (eg diuretic) or non-pharmacological (eg compression) treatment ■ Inappropriate dressing use/intervention	■ Inappropriate dressing use/intervention

Management of exudate and related problems

1. Assess the patient
- Comorbidities (wound and exudate aetiology)
- Medication
- Cooperation with therapy
- Psychosocial issues
- Nutritional status

2. Assess the region of the wound
- Local disease, eg venous disease/other skin conditions
- Wound position

3. Assess the current dressing
- *In situ* and after removal
- Use as an indication of amount

4. Assess the exudate
- Colour
- Consistency
- Odour

5. Assess the wound base and edge
- Wound history
- Size
- Stage of healing
- Infection/ inflammation
- Fistula/sinus

6. Assess the periwound skin
- Maceration/excoriation – reddening/loss of colour, spongy texture, loss of skin surface

➢ Assess the current dressing

➢ ▪ Evidence of leakage – Inspect for leakage and any modifications made by the patient to contain exudate, eg the use of plastic bags. The floor, patient's shoes, bed linen and clothes may also indicate leakage. Is odour detectable before dressing removal?

➢ ▪ Assess any secondary dressings/bandages – Is there strikethrough? Assess heaviness/wetness of the dressing, and colour, consistency and odour of exudate.

➢ ▪ Assess the current primary dressing in situ and after removal – Is there strikethrough? Assess the heaviness/wetness of the dressing, and colour, consistency and odour of exudate.

- Ease of dressing removal – Evaluate any dressing adherence. Assess the presence, quality and degree of any pain during the procedure.

- Frequency of dressing change – Is the frequency of dressing change appropriate for the patient and the wound? Has dressing change frequency changed recently? How long has the current dressing been in place? Ask the patient how long after dressing change strikethrough or leakage occurred.

- Dressing type and fixation – Is the dressing type appropriate? Is the dressing comfortable, conformable and flexible? Is the fixation appropriate for the patient and the dressing? Does the dressing stay in place? Does the method of fixation damage the skin? Is the seal provided by the dressing and fixation sufficient to prevent leakage?

Assessment of dressing

Status	Indicators
Dry	Wound bed is dry; there is no visible moisture and the primary dressing is unmarked; dressing may be adherent to wound. **NB This may be the environment of choice for ischaemic wounds**
Moist	Small amounts of fluid are visible when the dressing is removed; the primary dressing may be lightly marked; dressing change frequency is appropriate for dressing type. **NB In many cases, this is the aim of exudate management**
Wet	Small amounts of fluid are visible when the dressing is removed; the primary dressing is extensively marked, but strikethrough is not occurring; dressing change frequency is appropriate for dressing type
Saturated	Primary dressing is wet and strikethrough is occurring; dressing change is required more frequently than usual for the dressing type; periwound skin may be macerated
Leaking	Dressings are saturated and exudate is escaping from primary and secondary dressings onto clothes or beyond; dressing change is required much more frequently than usual for dressing type

Table 4 | Strategies for achieving the desired moist wound environment

Aim	Stategies*
Increase wound moisture	■ Choose dressing type to conserve or donate moisture ■ Use thinner (less absorbent) version of current dressing ■ Decrease dressing change frequency
Maintain wound moisture	■ Continue current dressing regimen
Reduce wound moisture	■ Use thicker (more absorbent) version of current dressing ■ Change to dressing type of greater fluid handling capability ■ Add or use higher absorbency secondary dressing ■ Increase frequency of primary and/or secondary dressing change

*NB It is important to review strategies regularly and expect need for adjustment

Table 5 | Dressing materials for fluid handling

This table is intended to provide a broad overview of the indicated usages of dressing materials for fluid handling. The properties and licensed usages of individual products within the generic groups will vary and may differ from the broad generalisations made. The dressing type chosen for a particular wound is influenced by many factors including wound healing stage and the rate of healing progression.

Dressing material*	Indicated usage			
	Fluid conservation/ donation	Fluid control** Light	Medium	High
Permeable non-adherent wound contact layers (eg knitted viscose primary dressing)		✓		
Cotton, polyester or viscose fibres or fabrics		✓ mainly used as secondary dressings	✓	✓
Semi-permeable films	✓	✓		
Sheet hydrogels	✓	✓		
Amorphous hydrogels	✓	✓		
Sheet foams		✓	✓	✓
Cavity foams			✓	✓
Hydrocolloids		✓	✓	
Alginates			✓	✓
Carboxymethylcellulose fibres (Hydrofiber® dressings)			✓	✓

*Porous ceramic beads and cadexomer beads are under investigation for the management of exudate

** Further research is required to clarify what constitutes low, medium and high exudation. This document recommends using the dressing *in situ* as a guide to level of exudate production (see Table 3) and the suitability of the selected dressing

Does the dressing:

- stay intact and remain in place throughout wear time?
- prevent leakage between dressing changes?
- cause maceration/allergy or sensitivity?
- reduce pain?
- reduce odour?
- retain fluid (eg under compression)?
- trap exudate components (ie sequester)?

Is the dressing:

- comfortable, conformable, flexible and of a bulk/weight that does not impede physical activity?
- suitable for leaving in place for a long duration?
- easy to remove (does not traumatise the surrounding skin or wound bed)?
- easy to use?
- cost-effective?

MANAGEMENT OF EXUDATE-RELATED PROBLEMS

Problem	Principles of management
Psychosocial effects[10,11]	■ **Ask** the patient and their carers about psychological and social problems ■ A particular regimen may be required to accommodate the patient's day-to-day needs or a specific goal (eg wedding) ■ Involve the patient and carer in management decisions ■ Treat/prevent exudate-related problems ■ Evaluate regularly and consider whether specialist referral is required
Leakage and soiling	■ Review management of systemic and local contributory factors ■ Consider a thicker dressing of the same type or a different dressing type with a higher fluid handling capacity ■ Consider secondary absorbent dressing (if not already in use) ■ Ensure dressing seal is effective ■ Consider referral if contributory factors or leakage are difficult to control (ostomy products or topical negative pressure may be indicated)
Frequent dressing change	■ *As for leakage* ■ Consider use of a permeable non-adherent contact layer with a secondary absorbent dressing, changed as required to minimise wound bed disturbance
Periwound skin changes	■ Take action to prevent wound expansion ■ Is the cause contact with exudate, dressing sensitivity/allergy or a dermatological condition? ■ Treat any inflammation as appropriate ■ Minimise skin contact with exudate and protect periwound skin with a suitable barrier ■ Increase fluid handling capacity of dressings ■ Consider atraumatic dressings and methods of fixation

Discomfort/pain[12]	■ Identify cause – how is exudate contributing to discomfort/pain? ■ Sudden increase in pain may be indicative of infection ■ Control excessive exudate and prevent/treat maceration and excoriation ■ Avoid/treat adherence of dressing to wound bed (see below) ■ Consider topical/systemic analgesic use
Odour	■ Remove necrotic tissue as appropriate ■ Reduce bioburden and manage underlying infection ■ Consider increasing dressing change frequency ■ May need to consider odour absorbing charcoal-containing dressings
Infection	■ Remove necrotic tissue as appropriate ■ Follow local protocols regarding use of systemic/local antimicrobials ■ Avoid increasing bioburden by preventing strikethrough and leakage
Delayed healing	■ Reassess patient and wound, checking for cooperation with treatment ■ Remove necrotic tissue and manage infection as appropriate ■ Ensure optimal moisture level ■ Consider change of dressing type or use of advanced therapy
Protein loss/fluid and electrolyte imbalance	■ Treat underlying cause and optimise nutrition ■ Ensure wound haemostasis ■ Consider referral if fluid loss is severe
Delayed autolysis	■ Consider debridement ■ If the wound is dry, increase wound moisture by using a dressing of lower fluid handling capacity or one that retains or donates moisture
Adherence of dressing to wound bed	■ Use low adherence atraumatic dressings ■ Reconsider dressing choice, eg increase wound moisture by using a dressing of lower fluid handling capacity ■ Reconsider frequency of dressing change ■ Consider moistening dressing before removal