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## The Aging Skin:

Skin Changes, Wound Development, and  
Pressure Injuries in the Elderly

Ana Endsjo. MOTR/L, CLT



### Faculty Disclosure

Ana Endsjo– MOTR/L, CLT  
National Education Manager



### Objectives

**1**

Name two functions of the epidermis, dermis and hypodermis layers of the skin.

**2**

List two age related changes that occur at each layer of the skin.

**3**

Name and describe one difference between each stage of a pressure injury.

### Wounds in the Nursing Home



**More than 1 in 10** nursing home residents have pressure injuries



Residents with “**high immobility**” have an **11% greater occurrence** than those without “high immobility”



Stage 2 wounds are the most common, accounting for **50%** of all pressure injuries



Pressure injuries are **12%** more prevalent among residents with bowel and bladder incontinence



Residents with recent weight loss are at **higher risk** to develop pressure injuries



**\$43,180** is the average cost to treat a pressure injury

## What makes a nursing home resident so susceptible to wound development?

- Most residents are wheelchair users:
  - An **estimated 70% - 80%** of residents in a nursing home are wheelchair users
- Of that 70-80%, **40-80%** need seating interventions to prevent pressure injuries
- Most wheelchair users are not mobile or have very limited mobility:
  - **2/3** of nursing home residents use a wheelchair as a **primary** mode of locomotion



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## What makes clients so susceptible to wound development?



Clients sit in wheelchairs for **prolonged** periods of time, making them more defenseless to the **EXTRINSIC FACTORS** of wound development: *pressure, shear and microclimate*



Lack of trunk and pelvis strength to maintain an optimal alignment increases the incidence of sliding into **one of the five abnormal postures** that place more **pressure on bony prominences**, leading to wound development



**Co-morbidities that compromise skin integrity** such as diabetes, vascular insufficiency and nutritional deficiencies, leave the skin more vulnerable to skin breakdown.



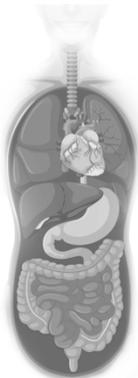
**Age related skin changes naturally increase the skin's susceptible to skin breakdown**

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Causes of wound development: **INTRINSIC FACTORS**

**Factors stemming from within the body that make an individual more susceptible to wound development**



- Age related skin changes
- Poor nutrition and dehydration
- Urinary and fecal incontinence
- Limited mobility
- Impaired sensation
- Postural deformities
- Medical conditions affecting blood flow
- Obesity
- Being Underweight
- Limited Alertness
- Muscle Spasms
- Smoking

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Causes of wound development: **EXTRINSIC FACTORS**

**Factors that stem from the environment that a therapist can address directly through equipment choices**

**Prolonged Pressure**



**Shear**



**Microclimate**



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## Prolonged Pressure

Continuous physical force applied directly on or against an area of the body, making skin more susceptible to a pressure injury

Direct pressure usually occurs at the bony prominences creating peak pressures

Common areas of occurrence due to poor wheelchair positioning are at the ITs, sacrum, coccyx, trochanter and spinous process

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## Shear

Historically not understood

The understanding of shear and the severity of damage to soft tissue is now heavily taught

Therapists can protect against shear through the appropriate wheelchair configuration and equipment choices

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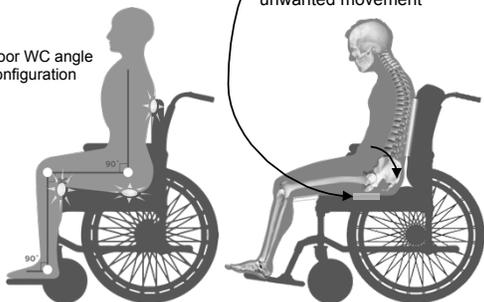


## Shear

**Happens while the client is in movement: during weight shifts, reaching, repositioning, or sliding into unwanted postures**

Client forced to sit in a posture they cannot tolerate

Poor WC angle configuration



Client slides into unwanted posture  
**Friction = Brakes** try to stop the unwanted movement

**Shear is a combination of downward pressure and static friction**

Downward pressure from gravity + inertia > the friction, movement will continue

Shear results = Friction causes the skin/ soft tissue & muscle to "stick" to the seat surface while the bony prominences continue the path of movement



Result: Deformation of cell structure of deep layers of tissue and tearing of blood capillaries leading to permanent cell death and skin breakdown.

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## Microclimate

Buildup of excessive heat and/or moisture at the seat surface

Removes natural oils needed to lubricate and protect the skin

Overhydrates and softens the skin and connective tissue, leading to maceration due to:

- Urinary or bowel incontinence
- Excessive sweat
- Drainage from existing wounds

The effects of pressure and shear are increased when microclimate is present



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### Why is our skin so important?

Largest organ in the body

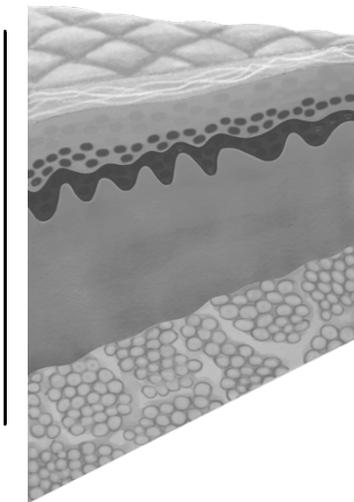
4 main functions: protection, thermal regulation, sensation, endocrine function

Acts as a barrier to pressure, stress, trauma, environmental elements



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### Skin Layers



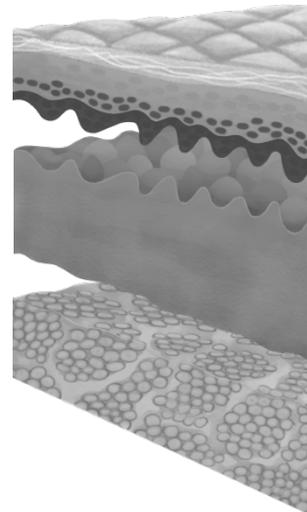
Made up of **3 layers**:

**Epidermis**

**Dermis**

**Hypodermis**

(deeper subcutaneous layer)



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## Taking a deeper look at each skin layer and their function

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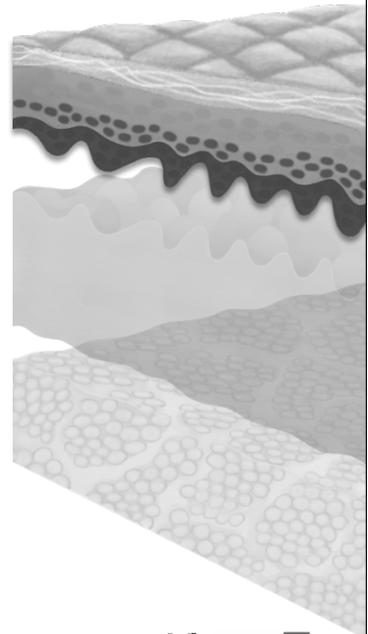
### Epidermis: Outermost layer



Has a thin, oily coat that protects the body from infection by preventing bacteria, virus and fungi from entering through the skin



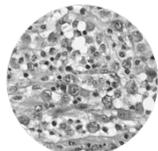
Acts as a waterproof barrier, preventing the entry of harmful external fluid and locks moisture in to prevent dehydration



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## Epidermis: Outermost layer



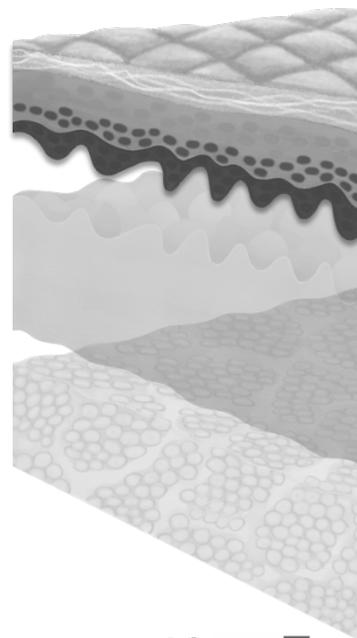
Houses Langerhans cells that have an immune function to fight against pathogens that come into contact with the skin surface - Alert a person that an infection is present by causing a temperature change or reddening of the skin



Sheds dead skin cells and makes new skin cells: important in wound healing



Synthesizes vitamin D



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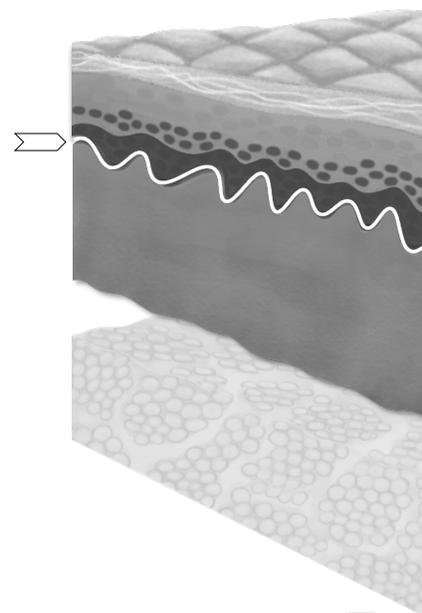
## Functions of the Dermal-Epidermal Junction

Junction has finger-like waves that interlock the dermis and the epidermis

These finger-like waves allow for blood flow and the exchange of nutrients and oxygen from the dermis to the epidermis

This exchange allows the epidermis to continuously replace damaged, dead skin cells with healthy ones to maintain skin integrity and plays an integral part in wound healing

This also helps maintain the thickness of both layers of skin



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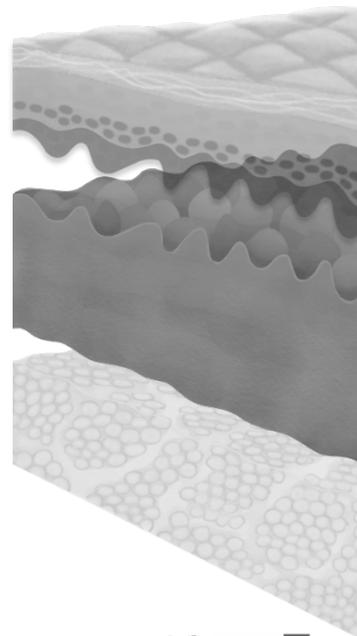
## Dermis

### 90% of your skin's thickness

Layer most responsible for protecting the body against physical stress

### Made up of:

- Fibroblasts cells
- Proteins and connective tissue
- Blood vessels
- Lymphatic vessels
- Nerve fibers
- Sebaceous glands
- Sweat glands



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## Dermis

### Fibroblast Cells

Fibroblast cells produce the proteins, collagen and elastin, that maintain skin health and repair it after injury

### Collagen

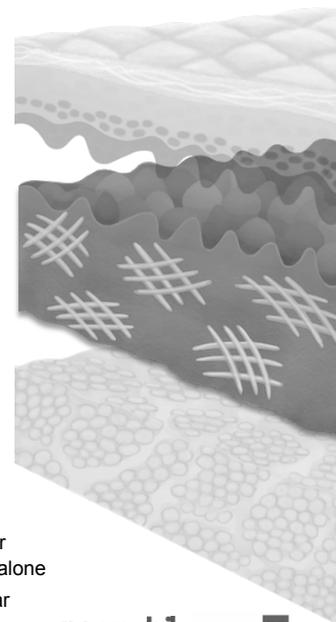
- Provides skin its strength and form
- Tensile strength- how much tension the skin can withstand before breaking open

### Elastin

- Interwoven within collagen fibers
- Provides skin its elasticity when force is applied
- Elasticity- the pliability of the skin to stretch with pressure & return to its original shape when the pressure is removed

### Viscoelasticity

- Dermis' ability to deform and "give" even more when pressure AND friction are applied because it takes into account the fluid component of skin with the elastin fibers
- Provides protection against injury caused by shear as it allows for additional movement beyond the capability of the elastin fibers alone
- Important when understanding the skin's ability to withstand shear



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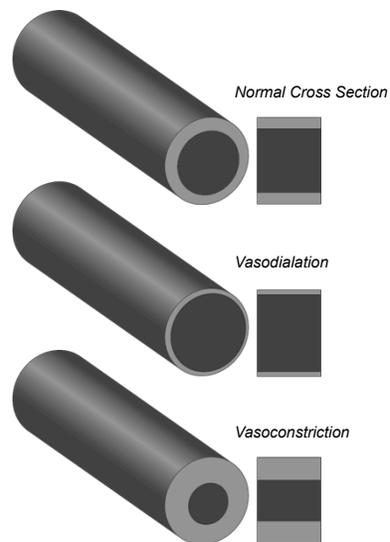
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## Dermis



### Blood Vessels

- Transport oxygen-rich blood and nutrients to the skin cells at each layer to maintain health and promote wound healing
- Carry away waste products
- Aide in temperature regulation:
  - Vasodilatation (relaxation) of blood vessels allows the body to release heat and lower the body temperature
  - Vasoconstriction (contraction) helps to retain internal body temperature



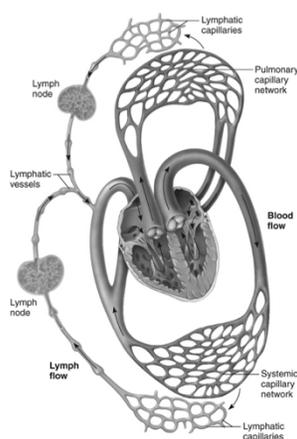
## Dermis



### Lymphatic Vessels

The primary function is to transport lymph, a fluid containing infection-fighting white blood cells, throughout the body

- Excrete toxins
- Absorb necessary nutrients



### Nerve Fibers

Allow for reception of various sensations:

- Temperature regulation of heat and cold
- Pain
- Pressure
- Deep touch

## Dermis



### Sebaceous Glands

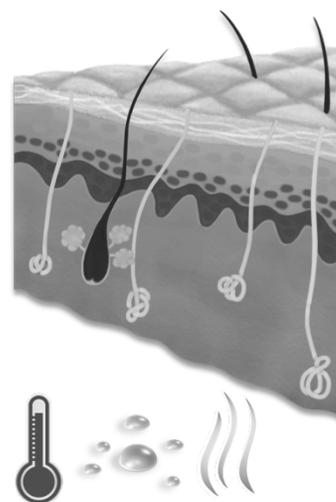
Produce the oil (sebum) secreted through tiny ducts to the surface of the skin that:

- lubricates the skin to prevent it from becoming dry and brittle
- creates a waterproof barrier to prevent maceration and lock in needed moisture



### Sweat Glands

- Produce sweat which is secreted through tiny ducts to the surface of the skin:
- The sweat regulates temperature by making the surface of the skin moist
- This moisture then evaporates and lowers the temperature of the skin to cool you down
- Excrete toxins through the pores



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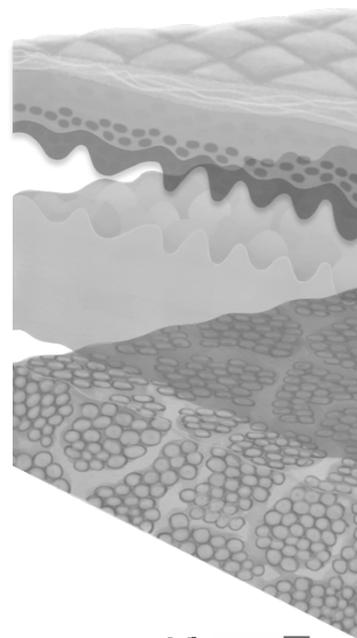
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## Hypodermis: Deeper subcutaneous layer

Makes up 15% – 20% of individuals body weight

Made up of:

- Fat cells
- Connective tissue with major:
  - Blood vessels
  - Lymph vessels
  - Nerve endings



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## Hypodermis



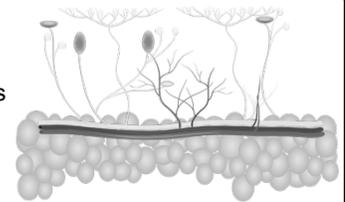
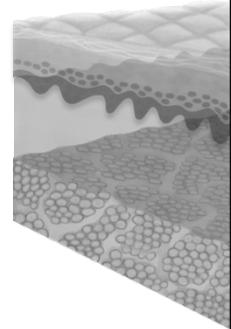
**Fat Cells**

- Act as an insulation barrier preventing heat loss, regulating the effects of cold temperatures
- Absorb shock to the skeleton

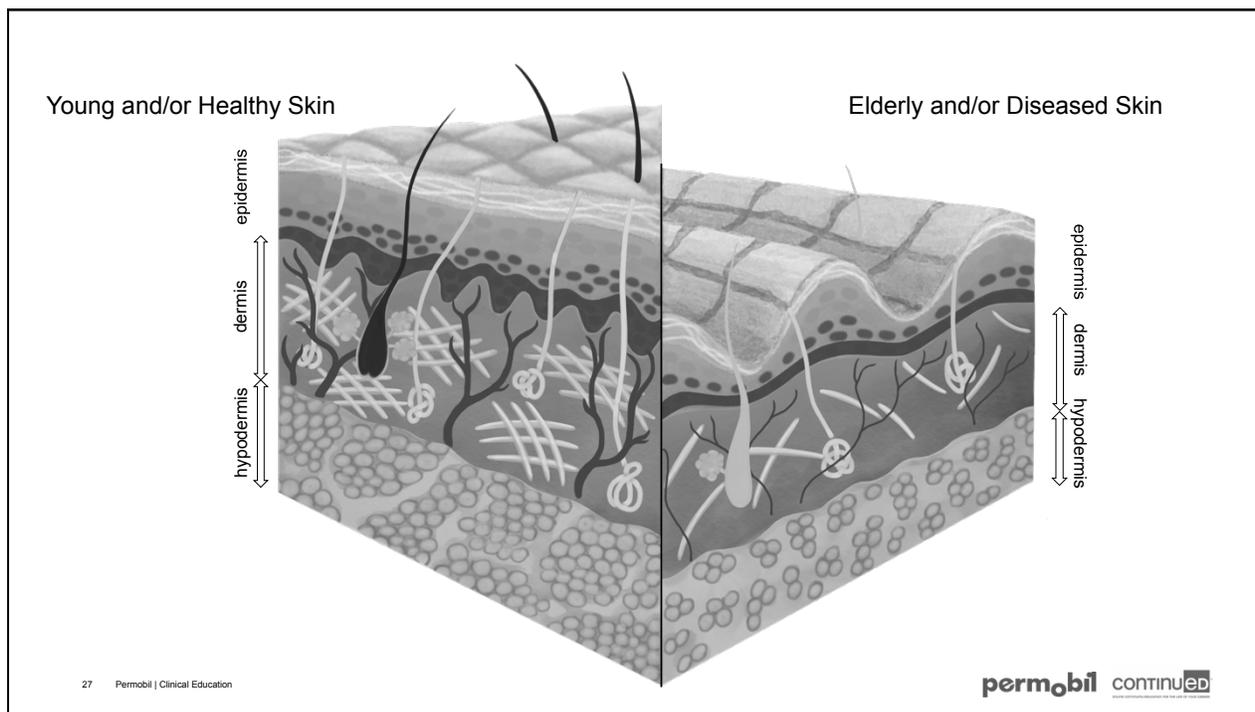


**Connective Tissue**

- Connective tissue anchors your skin to the deep fascia surrounding muscles and bones, allowing the skin to glide over deep structures
- Blood vessels and lymphatic vessels carry the blood and lymph to the dermis
- Supply oxygen and nutrients to the tissues in the hypodermis, dermis, sebaceous glands and sweat glands



## Understanding the disease process and age-related skin changes by layer

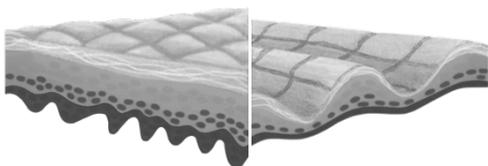


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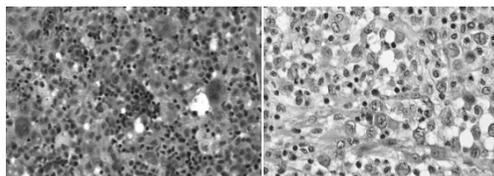
## Epidermis

### Epidermis thins



- Thickness decreases **6.4%** per decade
- Cell turnover rate decreases by **30 - 50%** between ages 30 and 80
  - Increases wound healing time

### Decrease in Langerhans Cells



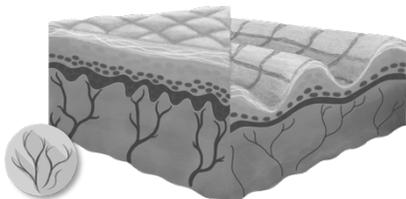
- Slows immune responses such as redness & temperature change that act as initial signs injury has occurred to the skin

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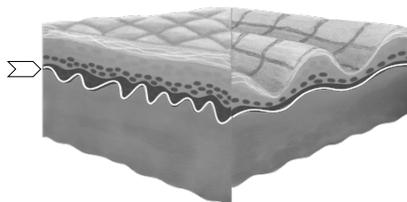
Epidermis - Dermis

**Decreased Vascularization**



- Thinner, weaker blood vessels are more easily damaged and torn with injury
- Decreased blood flow, O<sub>2</sub> and nutrients slows wound healing time

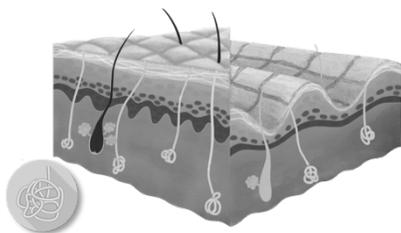
**Dermal-Epidermal Junction Flattens out**



- Dermal-epidermal junction flattens by **35%**, decreasing **blood flow, O<sub>2</sub>** and **nutrients** flowing between dermis and epidermis, **thinning both layers** of skin

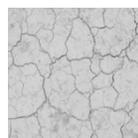
Epidermis - Dermis

**Decreased number of sweat glands at dermis**  
- effects sweat secreted to the epidermis



Decreases the client's ability to dissipate heat and evaporate excess moisture build up at the seat surface

**Decrease in sebaceous glands at dermis**  
- effects oil secretion at the epidermis



Decreased sebum (oil) production and secretion from the sebaceous glands equals drier, more brittle skin



Loss of waterproof barrier that prevents damage from excess moisture exposure

## Dermis

### Fibroblasts decrease production of collagen and elastin

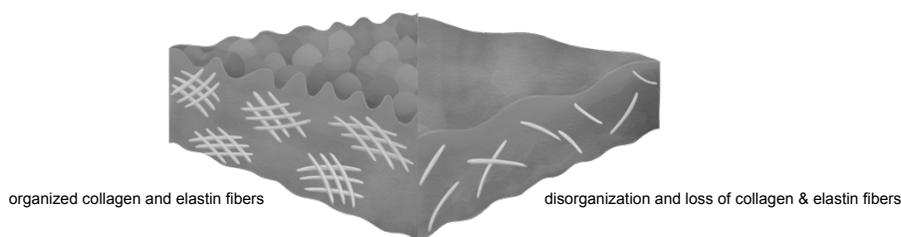
- Decrease in the skin's tensile strength and elasticity; the skin is unable to "snap back" to its original shape
- Collagen and elastin are disorganized and no longer interwoven, resulting in loss of cellular strength

### Decrease in thickness

- Decreased thickness of the dermal layer makes deeper tissues more susceptible to injury
- Reduction in the barrier between the bone and pressure source

### Loss of viscoelasticity

- Elastin fibers are fewer in number and water content of the skin is diminished.



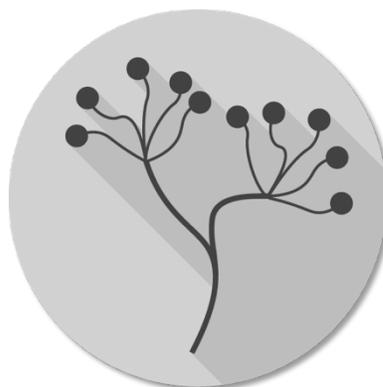
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## Dermis

### Nerve endings lose effectiveness to perceive input from pressure, heat, and cold

- Clients cannot feel the effects of pressure and friction at all layers of the skin
- Client is unable to detect a build up of excess heat at the seat surface
- Longer processing time of painful stimuli and pressure
- Longer reaction time to perform weight shifting and pressure relieving techniques



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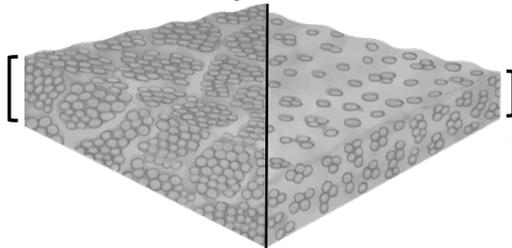
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## Hypodermis



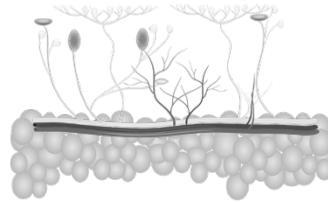
### Decreased adipose (fatty) layer

- Fat cells redistribute more to the stomach and thighs away from under bony prominences
- Lose the insulation; loss of the skin's capability for thermoregulation



### Decrease in connective tissue

Causes skin to be less firm and resilient to trauma



**How do these skin changes increase the skin's susceptibility to the Extrinsic Factors?:**  
***Pressure, Shear and Microclimate***

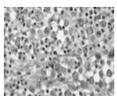
Increased susceptibility to:

### Pressure



- Thinner skin results in a reduction of the barrier between the bone and pressure source, increasing the susceptibility to break open under the body prominences more easily as a result of pressure or trauma

- Prolonged sitting in an abnormal posture increases the risk of ischemia and tissue death due to:



- Loss of Langerhans cells diminish the body's initial response to alert the caregiver and/or client that injury is occurring due to prolonged pressure
- Decreased sensitivity creates longer processing and reaction time to painful stimuli and pressure, taking longer to perform weight shifts and pressure relieving techniques

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Increased susceptibility to:

### Pressure



- A decrease in skin's tensile strength reduces the amount of force needed to initially break open the skin. The loss of skin elasticity decreases the skin's ability to "snap back" to its original shape when pressure is removed, increasing susceptibility to break open when pressure is reapplied at the bony prominences



- In the hypodermis, redistribution of fat cells away from under the bony prominences makes the skin more susceptible to peak pressures under a bony landmark



- Decreased blood flow, O<sub>2</sub> & nutrients exchange between the layers of the skin, slows healing time after an injury has occurred

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Increased susceptibility to:

### Shear



- Thinner skin with less vascularization and more fragile blood vessels will tear more easily with shear forces, causing permanent cell deformation



- Due to disorganization and loss of collagen & elastin fibers, cellular strength is lost, making it easier to permanently deform cellular structure of the skin from downward pressure and friction applied to the soft tissue



- Elastin fibers are fewer in number and water content of the skin is diminished causing a loss of the viscoelastic property of the skin. When shear forces are applied, the skin can no longer deform then return to its baseline shape, resulting in **permanent** cell deformation and death

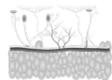


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Increased susceptibility to:

### Shear



- Hypodermis- fibrous bands and connective tissue that anchor the skin to the deeper tissue is lost, the skin is not as firm and resilient. When the frictional force ("the brakes") is applied to stop movement, it is easier to tear and distort the cells of deep tissue and blood vessels causing permanent deformation and death of the soft tissue



- Decreased blood flow, O<sub>2</sub> & nutrients exchange between the layers of the skin, slows healing time when an injury has occurred

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Increased susceptibility to:



### Microclimate



- Loss of the sebum production causes a loss of the waterproof barrier allowing excess moisture to macerate the skin more easily especially with incontinence, sweat and drainage from a wound are present



- Loss of sweat glands decreases ability to dissipate heat and evaporate excess moisture build up at the seat surface, leading to easier maceration



- Impaired nerve endings, decreases detection of excess heat build up at the seat surface, raising the temperature of the skin

Increased susceptibility to:



### Microclimate



- Raised body temperature increases metabolic rate, demanding more O<sub>2</sub> to be delivered to the tissues



- Decreased vascularization however diminishes O<sub>2</sub> supply allowing ischemia to occur more quickly when body temperature is raised



- At the hypodermis: Loss of insulation decreases the thermoregulation capability of the skin. So the body produces & reabsorbs more heat than it dissipates at the seat surface



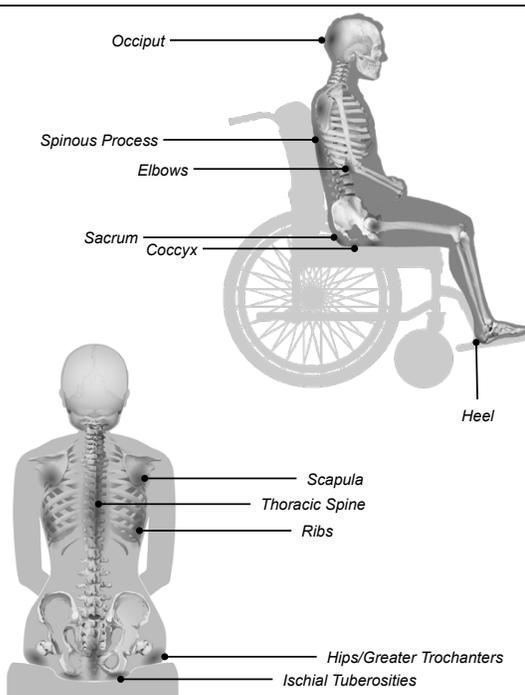
## Skin breakdown – Understanding the stages of pressure injury

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### Common areas of skin breakdown

Wound development at any of these areas can be classified in one of the stages of pressure injuries as defined by the NAUAP



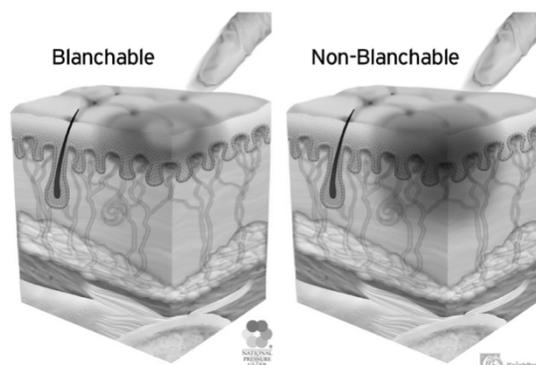
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## Blanchable Skin –

Testing for tissue damage: Blanchable or Non-Blanchable Skin

**To see if skin is blanchable, perform the fingertip test:**

- Press into skin with fingertip and hold for 3 seconds
- Remove pressure
- If **no color change** when finger is removed and skin stays red, then the skin is **non-blanchable**
- If **skin turns white** when the finger is removed, then the skin is **blanchable**



Pressure is present, but no tissue damage has occurred yet

Tissue damage has already occurred

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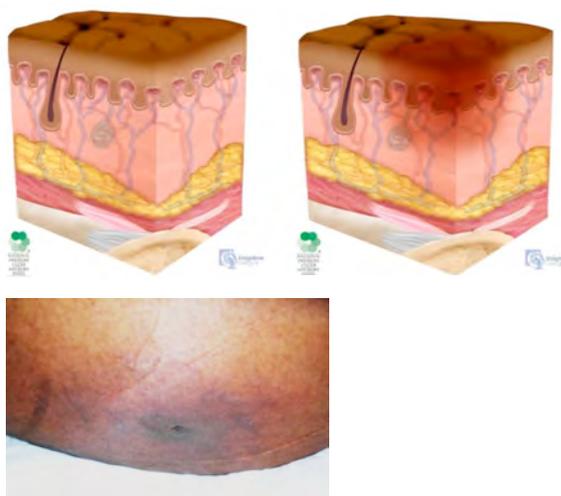
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## Blanchable Skin –

Testing for tissue damage: Darkly Pigmented Skin: Often no blanching response

### Darkly Pigmented Skin

- Sun Exposure
  - Gender
  - Race
  - Hormones
  - Age
- Inspect skin for discoloration in comparison to skin around it
  - Moistening the skin can help to see the color change
  - If cognitively intact, ask about pain in the area
  - Feel for induration of the skin: **Localized hardening of soft tissue of the body**. The area becomes firm, but not as hard as bone



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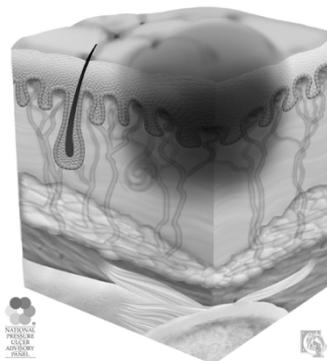
### Skin Breakdown –

Pressure injury classification: Stage 1

#### Non-blanchable redness of intact skin

- Skin is still intact, with localized non-blanchable redness of the skin
- Color change is not purple or maroon which would indicate a deep tissue injury

#### Stage 1 Pressure Injury - Lightly Pigmented



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KnightTime

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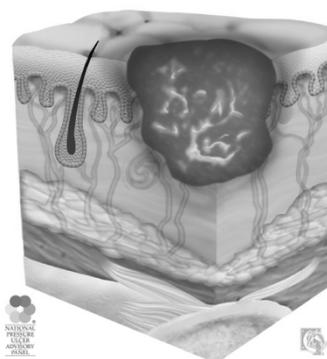
### Skin Breakdown –

Pressure injury classification: Stage 2

#### Partial thickness skin loss with exposed dermis

- The epidermis is gone. Partial thickness dermis loss but not the fatty, subcutaneous layer and deeper tissues
- Wound bed is pink or red, moist, and may present with intact or ruptured serum filled blister
- Commonly seen with adverse microclimate and shear in the skin over the pelvis

#### Stage 2 Pressure Injury



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KnightTime

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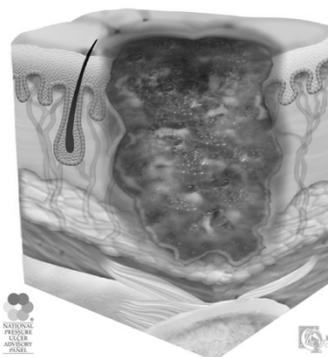
### Skin Breakdown –

Pressure injury classification: Stage 3

#### Full thickness skin loss

- Epidermis and dermis are gone
- Fatty tissue is visible
- Exposure of bone, tendon, or muscle has not happened
- May have undermining (spreading out wide) or tunneling (spreading down deep)
- Can be deep in an area with a lot of soft tissue

Stage 3 Pressure Injury



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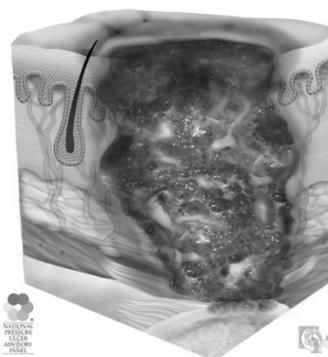
### Skin Breakdown –

Pressure injury classification: Stage 4

#### Full thickness skin and tissue loss

- Epidermis, dermis, and hypodermis are gone
- Exposed or directly palpable fascia, muscle, tendon, ligament, cartilage or bone
- Slough or eschar may be present in some parts of the wound
- Undermining and tunneling often occur

Stage 4 Pressure Injury



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### Skin Breakdown –

Pressure injury classification: Unstageable

#### Full thickness skin and tissue loss

- If slough and eschar are visible, then it becomes an unstageable pressure injury
- The extent of tissue damage cannot be confirmed because it is obscured
- If slough and eschar are removed, a stage 3 or 4 pressure injury will be revealed
- Must provide a skin protection cushion that would treat a stage 3 or 4 wound

#### Unstageable Pressure Injury - Slough and Eschar



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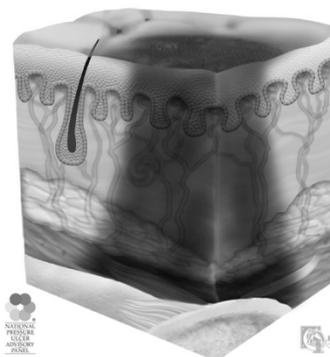
### Skin Breakdown –

Pressure injury classification: Deep Tissue Pressure Injury

#### Persistent non-blanchable deep red, maroon, or purple discoloration

- Intact or non-intact skin
- Non-blanchable deep red, maroon, or purple discoloration or epidermal separation revealing a dark wound bed or blood-filled blister
- Pain and temperature change usually first sign before skin color changes
- Occurs from intense prolonged pressure and SHEAR at the bone-muscle interface

#### Deep Tissue Pressure Injury



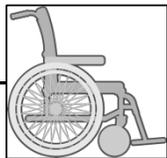
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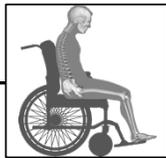
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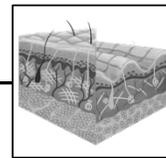
## Know the role of the therapist regarding wound care



Perform quarterly screens and identify clients at risk for skin breakdown



Recognize abnormal sitting postures that increase the client's susceptibility for skin breakdown



Understand age-related skin changes increasing vulnerability for wound development & classify the stage of pressure injury

*Pick the client up for a seating and positioning evaluation with the goals to:*

Choose the appropriate:

- Wheelchair Model
- Skin Protection Cushion
- Back Support
- Accessories

Provide optimal stabilization and alignment of the trunk, pelvis and LEs

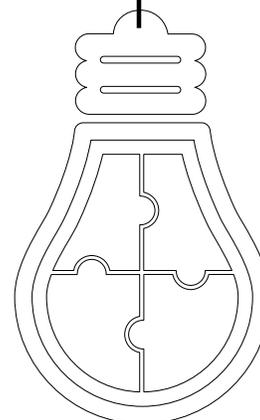
Protect the client against the extrinsic factors of wound development

## What is to come?

- A deeper understanding of the extrinsic factors of wound development and how to fight against each with your equipment choices
- Understanding the properties of a skin protection cushion in order to fight against the extrinsic factors of wound development

### Putting the pieces together:

With the hope to help you make the most informed decisions in regard to equipment choices when taking into account the prevention and treatment of wounds



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Thank you

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