

# Skin Self-Study Module

This self-study module will provide a foundation for clinicians to develop ongoing learning relating to skin and wound management

## Objectives

After completing this module you should be able to:

1. Discuss and differentiate some of the characteristics of skin and its underlying structures
2. Recognize skin and its underlying structural artifacts when encountered within the wound environment
3. Reflect on the effects of aging on skin
4. Explore common risk factors that may affect skin integrity
5. Identify some common solutions to reduce the risk for altered skin integrity.

## Anatomy & Physiology of Skin and Underlying Structures

Always be able identify what you are looking at, and what you are feeling!  
Ask yourself what am I seeing? Ask yourself what am I not seeing?

### Test Your Skin Care Knowledge

1. Skin is the largest human organ covering about \_\_\_\_\_ square feet
2. Skin makes up \_\_\_\_\_% of our total body weight
3. Skin has \_\_\_\_\_ miles of nerves in skin
4. Skin has \_\_\_\_\_ yards of blood vessels in skin
5. Skin has \_\_\_\_\_ bacteria per square inch of skin
6. \_\_\_\_\_ don't get fingerprints till 3 months
7. Humans shed and re-grow outer skin cells every \_\_\_\_\_ days
8. By the age of 70 an average person will have lost \_\_\_\_\_ lbs of skin
9. A fingernail or toenail takes about \_\_\_\_\_ months to grow from base to tip
10. We loose on average between \_\_\_\_\_-\_\_\_\_\_ strands of hair a day
11. The average scalp has \_\_\_\_\_ hairs
12. \_\_\_\_\_ are the fastest growing hairs on the human body

(answers at the end of module)

### Skin is...

- A barrier to protect the body from the environment
- A temperature regulator
- An immune organ to prevent and combat infections
- A sensory organ to detect temperature, touch, vibration etc

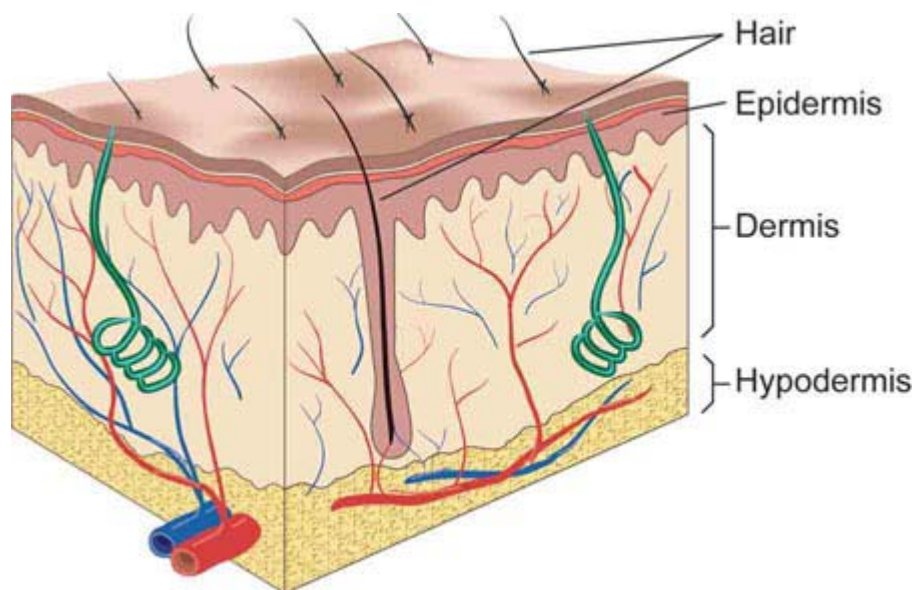
- A visible signal for social and sexual communication
- Working to renew itself every second of every day

### **Skin has two distinct layers:**

**Epidermis** is the outermost layer of the skin. It consists of two main cell types—**keratinocytes** and **melanocytes**—which are produced in the basal layer. The keratinocytes produced in the basal layer migrate upward toward the environment and change their shape to become the protective outer layer called the **stratum corneum**. This process takes approximately 28 days. The melanocytes provide the pigment to the skin. The epidermis also contains **hair follicles** and **sweat glands** (also called **eccrine glands**) which are known as **epidermal appendages**. These appendages are lined with keratinocytes and act as a source of keratinocytes in epithelializing partial thickness wounds. Other cells found in the epidermis are the Langerhans cells (for immunity) and Merkel's cells (for sensory stimuli). The primary function of the epidermis is protection. The epidermis contains no blood vessels. It may vary in thickness: very thin (0.5 mm) in some areas (tympanic membrane) to very thick (6 mm) in other areas (sole of the foot)

**Dermis** is the thicker layer of fibrous connective tissue that supports and binds the epidermis to the subcutaneous tissue (hypodermis). This layer produces **collagen**, **elastin** and **reticulin**, the substances that lend structure and support to skin. Unlike the epidermis the dermis is rich in a network of **nerves** as well as **blood** and **lymph vessels** that provides nutrition to itself and the epidermis.

**Figure 1: Skin diagram**



### **Skin Function**

Skin acts as a passive barrier and protects against trauma related to:

- water
- chemicals

- microbiologicals
- mechanical action
- irradiation

Skin acts as a dynamic barrier through the following mechanisms

- Immune: surveillance, processing antigens, eliciting responses
- Exchange: water, salts, gases, heat
- Sensory: touch, pressure, pain
- Metabolic: Vitamin D synthesis

**Subcutaneous tissue** (hypodermis) is composed of adipose and connective tissue and attaches dermis to underlying structures. Subcutaneous tissue acts as heat insulator, cushions and protects. In diseased states edema accumulates in the subcutaneous tissue. Subcutaneous tissue can be easily damaged, infects easily and heals poorly.

**Fascia** is gleaming white tissue with tough covering that wraps around muscle and provides the surgical plane. When you encounter the fascia during wound care it is a time to "stop and think," and look for signs of necrosis—infection is easily spread along fascial plane.

**Muscle tissue** is dull red with tremendous blood flow. Muscle tissue protects and pads, supports ambulation and function (you lose it when you remove it). It is contractile and when you encounter it in wounds it tears easily and doesn't grab well with forceps.

**Tendons** are cords of gleaming white fibrous tissue that attach muscle to bone, removal incapacitates attached muscle. They are covered by paratenon which nourishes the tendon and when encountered in a wound it must be kept moist to preserve its integrity. Tendons are easily infected, poorly vascularized and therefore heal poorly. Loss of tendon structure = loss of function.

**Ligaments** are cords of gleaming white fibrous tissue that attach bone to bone or other soft tissue to each other. They are covered by paratenon which nourishes the ligament and when encountered in a wound they must be kept moist if it is to remain viable. Tendons are easily infected, poorly vascularized and therefore heal poorly. Loss of structure, particularly bone to bone = loss of function.

**Bones** are hard and white with periosteum covering for external blood supply. Bones provides protection and rigid strength and support. They can granulate and when encountered in a wound must be kept moist to preserve the periosteum, if you have no periosteum you have dead bone. Exposure of bone is the road to infection.

**Joints** are located at the junction of bones to provide flexibility and agility. Though they have no blood flow in the joint they have a slippery synovial fluid within the joint cavity. When you encounter this bubbly, pale yellow synovial fluid in a wound it is time to "stop and think." There is an increased risk of infection with exposure to the joint cavity.

**Cartilage** is strong resilient white connective tissue that exists on the articular surface of joints and acts as a shock absorber by covering and cushioning the joints. They are poorly vascularized and rely on synovial fluid for nourishment. Cartilage infects easily.

**Blood and Lymphatic vessels** distribute hormones and nutrients to the cells and tissues of the body and transport waste products to excretory organs. When encountered in a wound watch for pulsation of structure.

- Arteries: carry the blood with nutrients and oxygen to the tissues
- Veins: convey the products of metabolism (carbon dioxide etc) toward the heart
- Capillaries: through their permeability allows the exchange between blood and tissues through their walls, The capillary bed connects the arterial system to the venous system.
- Lymphatics: return the fluid from the tissue spaces to the blood

Did you know that one square inch of skin has:

- 65 hairs
- 100 sebaceous glands
- 78 yards of nerves
- 650 sweat glands
- 19 yards of blood vessels
- 9,500,000 cells
- 1,300 nerve endings
- 20,000 sensory cells

## II. Skin Care and Maintenance

Skin reflects your general health and social behaviour. Keeping the skin clean is important to prevent infections and odours. Excess washing can cause loss of oil in the outer layers of the skin and provoke dermatitis. Chemicals can dry, irritate and damage skin leading to dermatitis. The young and the elderly have more sensitive skin because their barrier is less well formed. People who have had eczema, asthma or hay fever as children are more prone to these problems in adult life. The major cause of skin ageing is ultraviolet light.

### **Skin Changes with Normal Aging**

As we age our skin undergoes changes that put it at great risk for trauma:

- Thinning of the outer layer -1% decrease in collagen per year. Since collagen gives skin tensile strength, loss of it leads to wrinkling.
- Decreased melanocytes, the pigment producing cells
- Decreased numbers of Langerhan's cells, which serve as macrophage and immune moderators of the epidermis, and increases the risk of skin infections
- Decreased blood supply causes the dermis to become increasingly avascular with age which adds to the difficulty of healing damaged skin
- Increased dryness as the eccrine glands decrease in number and decrease sweat gland production
- Slowing of cell replacement causes a decrease turnover rate of the epidermis by 50%, which slows the healing process

- Decreased elasticity as elastin fibres significantly decrease in size and number. Since elastin maintains the skin's elasticity and recoil...loss leads to wrinkling.
- Decreased sensation to pressure and light touch and increased threshold for pain, leading to a type of neuropathy
- Atrophy of subcutaneous fat on hands, face, shins, waist in men and thighs in women...loss leads to sagging and folds.
- Decreased hair growth and numbers with associated graying with the decrease and loss of melanin.

A key to preventing altered skin integrity in any population is identification of factors that may affect skin AND creating a treatment plan for prevention and treatment of the risk factors. Table 1 lists some common risk factors as well as protection, prevention and treatment strategies.

**Table 1: Risk factors for altered skin integrity**

Risk factor	Protection / Prevention strategies	Treatment strategies
<b>Fragile skin</b>	<ul style="list-style-type: none"> <li>• Protect skin against trauma with good fitting, breathable clothing</li> <li>• Pad and protect bony areas</li> <li>• Always <b>patch test</b> new products</li> </ul>	<ul style="list-style-type: none"> <li>• Avoid over-bathing, excess heat and irritating lotions</li> <li>• Use pH balanced soaps and non irritating creams</li> <li>• Use humectant creams and lotions</li> </ul>
<b>Decreased mobility</b>	<ul style="list-style-type: none"> <li>• Encourage position changes</li> <li>• Passive/active exercises</li> <li>• Rehab consult (OT/PT)</li> </ul>	<ul style="list-style-type: none"> <li>• Pressure reduction/relief surfaces</li> <li>• Rehab consult (OT/PT)</li> <li>• Decrease friction and shear</li> </ul>
<b>Decreased sensation</b>	<ul style="list-style-type: none"> <li>• Good fitting, breathable footwear</li> <li>• Inspect footwear, do hand check</li> <li>• Education re: pressure ulcers</li> </ul>	<ul style="list-style-type: none"> <li>• Regular skin and foot assessment and nail care</li> <li>• Professional shoe fit</li> </ul>

<b>Decreased arterial flow</b>	<ul style="list-style-type: none"> <li>• Keep legs at or below heart level</li> <li>• Stop smoking</li> <li>• Low fat diet</li> </ul>	<ul style="list-style-type: none"> <li>• Vascular assessment</li> <li>• Medical and surgical consult</li> <li>• Protective footwear</li> </ul>
<b>Incontinence</b>	<ul style="list-style-type: none"> <li>• Incontinence pads</li> <li>• Effective barrier products</li> <li>• Toilet regularly</li> </ul>	<ul style="list-style-type: none"> <li>• Explore reason for incontinence</li> <li>• Routine peri-care - watch for signs of yeast</li> </ul>
<b>Poor nutrition</b>	<ul style="list-style-type: none"> <li>• Encourage a well balanced diet</li> <li>• Encourage fluids</li> </ul>	<ul style="list-style-type: none"> <li>• Dietary consult</li> <li>• Nutritional supplements as required</li> </ul>
<b>Leg edema</b>	<ul style="list-style-type: none"> <li>• Keep legs above heart level when sitting</li> <li>• Maximize mobility</li> <li>• Education re: edema management</li> </ul>	<ul style="list-style-type: none"> <li>• Assessment / application of compression therapy</li> <li>• Assessment / exercises of calf pump</li> </ul>

**Caution: Conditions may co-exist, therefore a holistic assessment is always required before initiating strategies.**

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### **Answers to Skin Quiz**

1. Skin is the largest human organ covering about 25 square feet.
2. Skin makes up 15% of our body weight.
3. Skin has 45 miles of nerves in skin.
4. Skin has 20 yards of blood vessels in skin.
5. Skin has 32 million bacteria per square inch of skin.
6. Fetuses don't get fingerprints till 3 months.
7. Humans shed and regrow outer skin cells every 27 days.
8. By the age of 70 an average person will have lost 105 lbs of skin.
9. A fingernail or toenail takes about 6 months to grow from base to tip.
10. We lose on average between 40-100 strands of hair a day.
11. The average scalp has 100,000 hairs.
12. Beards are the fastest growing hairs on the human body.

**Recommended Reading on CAWC Web site:**

[Intact Skin – An Integrity Not to be Lost \(PDF\)](#) • R. Gary Sibbald, MD, FRCPC(Med)(Derm); Karen Campbell, RN, MScN, NP/CNS; Patricia Coutts, RN; and Douglas Queen, BSC, PhD, MBA

[The Impact of Musculoskeletal Changes on the Dynamics of the Calf Muscle Pump \(PDF\)](#)

• Heather Orsted, RN, BN, ET; Lori Radke, BScPT; and Richelle Gorst, BScPT

[Health of the Aging Foot](#) • Shane Inlow MD