

ProCare Training Manual

Chapter 7

Pressure Ulcers

Pressure ulcers are a growing problem. It is estimated that 15% of the elderly will get a pressure ulcer. Pressure ulcers are also prevalent in patients with spinal cord injuries and those that are mobility impaired (obesity, etc.). The costs associated with pressure ulcers have greatly risen over the past 10 years and are currently so extreme, that many insurance companies track specific interventions in hope of finding that which is the most cost effective. Home health agencies have also been helpful in providing data on pressure ulcers through the use of the OASIS Forms (Outcome and Assessment Information Set). These forms are mandated by CMS in order to bill for Medicare services for pressure ulcers.

Pressure ulcers are chronic wounds resulting from tissue death due to prolonged, irreversible ischemia brought on by compression of soft tissue. Tissue compression interferes with circulation, reducing or completely cutting off blood flow. Muscle and fat are less tolerant of interruptions in blood flow than skin. Therefore, by the time signs of impending necrosis appear on the skin, underlying tissue has probably suffered substantial damage. Therefore, always think of the damage to the skin as the “tip of the iceberg.”

Pressure ulcers are most common in areas where pressure compresses soft tissue over a bony prominence in the body. Other factors that contribute to the problem include shear, friction and moisture.

The Pressure is On

In order to plan effective interventions for prevention and treatment of pressure ulcers, you must first have a clear understanding of the etiology of pressure ulcers. As pressure increases on tissues, capillaries collapse and thrombose. This causes a toxic metabolic by product to build up in the surrounding tissues, thereby causing the tissues to die. Since the skin is more tolerant to interruptions of blood flow than the fat or muscle, once the signs of necrosis or pressure ulcer appear on then skin, there is usually significant damage that has already occurred in the underlying tissues.

When the external pressure exceeds the venous capillary refill pressure, which is about 12 mm hg, capillaries begin to “leak”. This causes further circulation problems and forces blood into the nearby tissues. This is indicative of nonblanchable erythema. With continued capillary occlusion, lack of oxygen and nutrients as well as the buildup of edema, the necrosis of muscle, subcutaneous tissue and ultimately the dermis and epidermis occur.

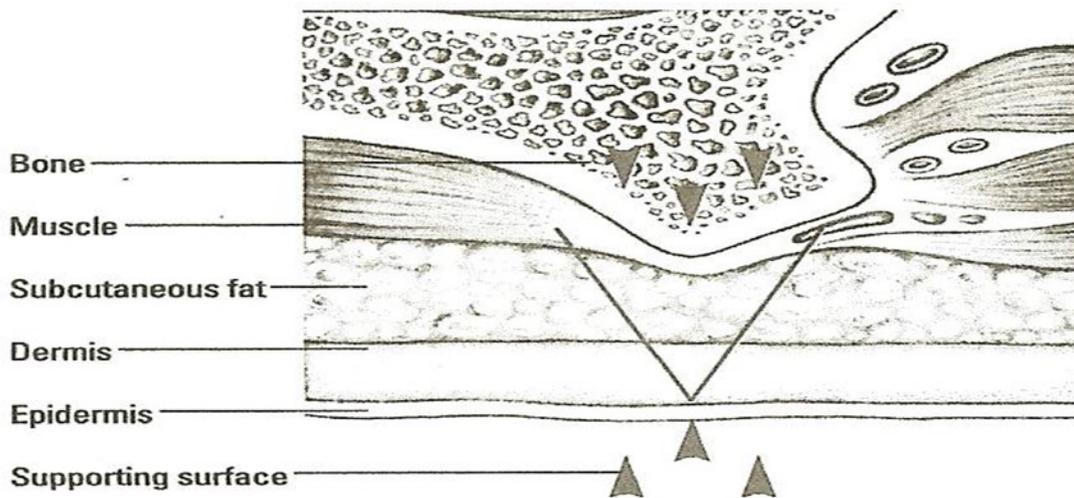
Beginning Signs of Pressure

There are 3 signs of pressure, they are:

- 1) **Reactive Hyperemia-** First visible sign of ischemia. A reddening of the skin is due to a protective mechanism in the body that dilates vessels in the affected area to increase the blood flow and speed oxygen to starved tissues. When the pressure causing the ischemia is released, the skin flushes red as blood rushes back into the tissues. This redness lasts about 1/2-3/4 as the ischemic period, and if the pressure is relieved, tissue damage is usually halted.
- 2) **Blanchable Erythema-** Can signal imminent tissue damage. This simply stated is redness that blanches. When pressing a finger tip in the reddened area, the area turns white then immediately red again. Tissue exhibiting signs of blanchable erythema usually resumes it s normal color within 24 hours and suffers no long-term effects it the pressure is relieved. In dark skinned individuals, erythema is hard to discern. Use a bright light and look for taut, shiny patches of skin with a purplish tinge. Also, assess carefully for localized heat, induration, or edema, which can be better indicators of ischemia than erythema.
- 3) **Nonblanchable Erythema-** This is usually the first sign of tissue destruction. In high risk patients, nonblanchable tissue can develop in as little as 2 hours. The redness associated with nonblanchable erythema is more intense and does not change colors (to white) when compressed with a fingertip. If this is recognized and all pressure is relieved, it can be reversible.

The force associated with any given pressure increases as the amount of body surface exposed to the pressure decreases. That is why it is important to offload these areas and distribute the load of the pressure. Bony Prominences are particularly susceptible to pressure. Bony prominences set up a pressure gradient in which the pressure is greatest on tissues at the apex of the gradient and lessens to the right and left of this point. It is basically a “V” shape with the bony prominence being the apex of the “V”.

Figure 7-A “V” shaped pressure gradient



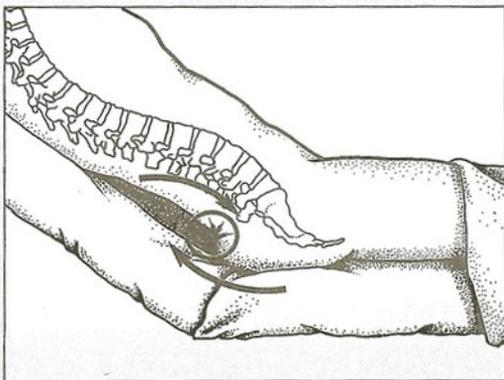
When structures such as blood vessels, muscle, subcutaneous fat and skin are compressed between a bone and an external surface, such as a bed or a chair, pressure is exerted on the tissues from both the external surface and the bone. When a person is lying supine in bed, the force of pressure exerted on the buttocks is about 70 mm hg. When the same person is sitting upright in a chair, the force on the ischial tuberosities can be as much as 300 mm hg. Remembering that venous capillary pressures are about 12 mm hg, it is imperative that appropriate position changes take place. A sustained, low pressure is far more damaging than high pressures for short periods. Pressure ulcers can occur from a period of one time high pressure; although, they are more likely to be caused by sustained pressure.

Remember the “tip of the iceberg”? Pressure ulcers are often deeper than what first meets the eye. Pressure ulcers also seem to “evolve” over time. Whenever pressure is relieved from an area, the underlying tissue may have already suffered extensive capillary damage leading to tissue necrosis. Thus, whenever an ulcer is discovered, treatment should start immediately beginning with the reduction of the causative factor, the pressure.

The Shear Factor

Shear is another force that causes pressure ulcers. It is the mechanical force that is usually associated with repositioning or when a patient slides down after being placed in high Fowler’s position. Shear is a mechanical force parallel, rather than perpendicular, to an area of tissue. As the body is pulled down in a bed by gravity, the skin on the back resists the motion because of friction between the skin and sheets. Meanwhile, the bony structures and attached tissues slide underneath the skin causing the skin to pucker in the gluteal area. (See Figure 7-B) This typically results in triangular shaped sacral ulcers and the large areas of tunneling or deep sinus tracts beneath these areas. One way of decreasing the risk of shear injuries is to elevate the head of the bed 30 degrees or less while the patient is in bed. The lower incline, decreases the amount of gravity pulling the patient downward.

Figure 7-B Sheer Factor



Friction

Friction is another potentially damaging mechanical force. Friction develops as one surface moves across another surface. An example of this is when a patient is being transferred or repositioned in bed without the use of a draw sheet. Abrasions are wounds caused by friction. In bed bound patients, friction and shearing forces combine to increase the risk of tissue damage in the sacral region.

Excessive Moisture

Prolonged exposure to moisture can macerate the skin. This contributes to pressure ulcer formation in that it softens the connective tissue. Macerated epidermis erodes much easier and will eventually slough off. Moist skin also adheres to linens making the friction's effect more profound. Consequently, damp skin is five times more likely to develop ulcers than dry skin.

Risk Factors

There are several risk factors that contribute to pressure ulcer formation. These include:

- Advancing age
- Immobility
- Incontinence
- Infection
- Low Blood pressure
- Malnutrition

Age

With age, the skin becomes more fragile as the epidermis turns over more slowly, vascularization decreases and skin layers adhere less securely to one another. Older adults have less lean body mass and less subcutaneous tissue to cushion against the bony prominence. This is often why an elderly person's skin appears "thinner". Think of two foam egg crate mattresses with the peaked edges facing each other and interlocking like a puzzle. These edges are symbolic of the rete ridges found in the dermis. As we age, our skin ages and the rete ridges flatten. This decreases the perceived thickness of the skin as well as increases the trauma associated with shear, friction and moisture imbalance.

Immobility

Immobility may be one of the greatest risk factors for pressure ulcer development. Immobility not only includes the elderly bed bound patient, but also the paralyzed or sensory impaired patients. Many of the diabetic population suffer from neuropathy, which also poses a threat to pressure ulcers related to immobility because they are unable to sense that the pressure needs to be off loaded. Typically, perfusion can be interrupted to the skin after as little as two hours, therefore, it is imperative that patients that are unable to shift their body weight to reduce pressure be repositioned frequently. The same theory is true for diabetics with neuropathy, they need to inspect their feet daily and always wear shoes that are the appropriately sized to decrease callous formation and pressure secondary to bony prominences.

Infection

Although the role of infection in pressure ulceration isn't fully understood, researchers have concluded that compressed skin lowers local resistance to bacterial infection and that the presence of infection may reduce the amount of pressure needed to cause tissue necrosis.

Low Blood Pressure

Low arterial blood pressure is clearly linked to tissue ischemia, particularly in vascular patients. When blood pressure is low, the body shunts blood away from the peripheral vascular system in order to provide adequate perfusion to vital organs. In turn, this decreases the amount of blood, oxygen and nutrients that is delivered to the vascular structures supplying the skin. As this perfusion decreases, the skin is less tolerant of sustained external pressure, and the risk of damage due to ischemia increases.

Malnutrition

There is a strong correlation between poor nutrition and pressure ulceration. Unfortunately, nutrition is often overlooked or supplemented inadequately. A patient's serum albumin and prealbumin levels are important indicators of the protein stores the body has available for wound healing. These levels are important because skin is primarily comprised of protein. If these levels are low, the body lacks an essential building block for skin repair. The healing process can be delayed because albumin is the blood component that provides colloid osmotic pressure (the force that prevents fluid from leaking out of blood vessels into nearby tissues). Without appropriate stores, this can lead to increased edema and hypotension, which can slow or stop wound healing. Think of albumin as the magnet within the blood stream to attract water and keep it within the vascular system.

A low albumin level (less than 3.5 g/dl) is late indicator of protein deficiency. This is a late indicator in that albumin levels are a snap shot of the patient's protein store history over the last 2-3 weeks. Prealbumin on the other

hand, is a snapshot of the dietary stores of protein within the last few days. A prealbumin level is the preferred laboratory indicator to determine adequate protein stores for wound healing.

This is especially true when a deficiency has been noted and you are attempting to increase the patient's protein stores with dietary supplements. A wound care patient that is otherwise healthy needs between 0.8g/kg/day to 1.6g/kg/day of protein to support wound healing. This is the equivalent of 2 or 3 -three ounce servings of protein each day in the form of meat, milk, cheese, eggs, beans or legumes. There are also many commercial preparations of protein supplements in the forms of drinks and powders. See table 7-C for a list of foods containing protein.

Table 7-C Sources of Protein

<p>Milk: whole, 2%, 1%, skim (skim and 1% are lowest in fat & cholesterol)</p> <p>Eggs: whole eggs, egg whites, egg substitute (egg yolks are high in cholesterol)</p> <p>Very Lean & Lean Meats: skinless chicken or turkey; fresh fish or shellfish, fish canned in water; low-fat or fat-free cheeses, cottage cheese; select or choice grades of lean beef, especially loin, flank, or round, $\geq 90\%$ lean ground beef; loin pork chops, Canadian bacon, $\geq 95\%$ lean luncheon/sandwich meats</p> <p>Legumes: all varieties of beans</p> <p>Remember: milk and eggs are the standards against which all other proteins are graded.</p>

Prevention

Managing the intensity and duration of pressure is a fundamental goal in prevention, especially for patients with mobility or sensory limitations. Frequent repositioning and offloading the pressure helps to avoid the damage caused by repetitive pressure, namely, tissue ischemia and subsequent necrosis. Some key tips to remember for offloading pressure are:

- 1) Patients are more likely to develop a pressure ulcer while sitting than when lying down. The amount of pressure to the sacral region when lying down is about 70 mm/hg. The amount of pressure to the ischial tuberosities is nearly 300 mm/hg when a patient is sitting on a hard surface.
- 2) Tissue damage can occur in as little as 2 hours from lack of adequate perfusion secondary to low pressure forces, such as lying in bed with the head of the bed elevated to 30 degrees.
- 3) Tissue damage can occur in as little as 15 minutes under high pressure situations. Paraplegics and wheelchair bound patients should be instructed to shift their weight every 15 minutes to prevent tissue breakdown.
- 4) Bony prominences are the most likely area to suffer pressure ulceration but are not the only area.
- 5) Long uninterrupted low pressure can, and usually does, cause more extensive tissue necrosis than higher pressures at shorter intervals.
- 6) Decreased sensory perception due to diabetes or spinal cord injuries pose a significant risk to pressure ulcer development.
- 7) Non-compliant diabetics who do not wear shoes at all times or wear poorly fitting shoes are at increased risk for diabetic foot ulcers secondary to pressure from callous build-up or bony malformations.
- 8) Diabetics should be instructed to wear shoes that fit properly with a wide toe box made from materials that allow the feet to breathe such as leather or athletic shoes.
- 9) When breaking in a new pair of shoes, they should be cautioned to only wear the new shoes for 1-2 hours at a time until they are molded to their feet.

Figure 7-D Pressure Points while sitting

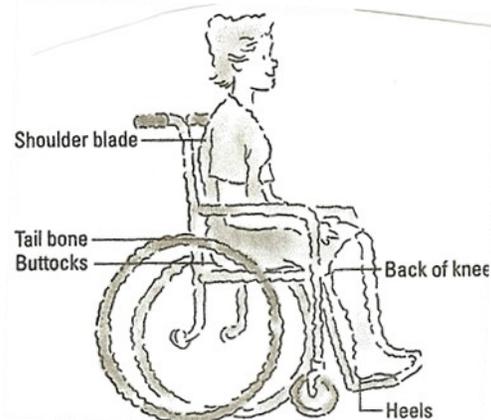
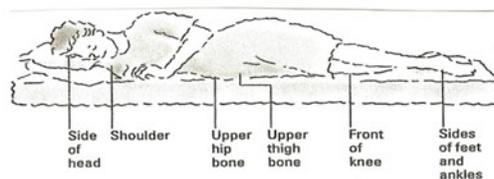
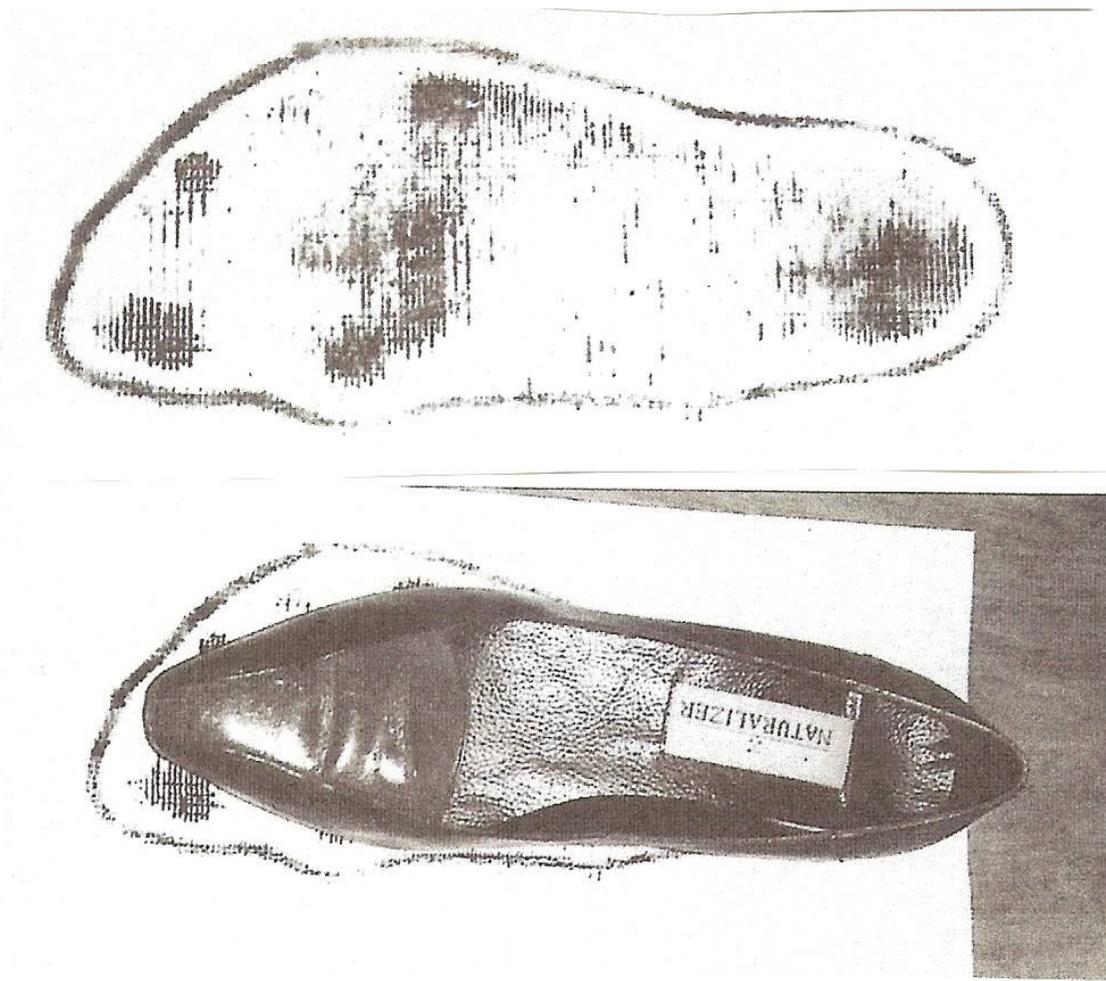


Figure 7-E Pressure points, lying-



Below is an example of a young lady who suffered from diabetic ulcers to the lateral edges of both feet. This young lady worked daily in an attorney's office as an office coordinator.

Figure 7-F Harris mat pressure map as compared to shoe patient was wearing



As you can see, the tracing of her foot does not fit within the confines of her shoe. Unfortunately, this is an all too often occurrence.

Offloading

There are numerous devices that can be used to offload pressure. From pillows to specialty air beds to custom made diabetic shoes, there are a number of different devices and materials that are used. It is important to familiarize yourself with the classes, types, and reimbursement of each of these products in order to provide effective management of pressure.

When using an offloading device it is imperative that you instruct the patient that this does not completely eradicate the pressure. Many patients and caregivers have a false sense of security when using offloading devices. It is important to remember that as helpful as these devices may be, they are not substitutes for attentive monitoring.

When using a wheel chair cushion, mattress replacement or bed replacement system, familiarize yourself with the manufacturer and specifications of the device. Many of these devices have weight limits that should be adhered to, otherwise, the patient will “bottom out” the device and the bony prominence will be against a hard surface. To check for bottoming out, slide your hand beneath the devices and supporting surface (palm up, fingers extended), if you are able to feel the patient’s body, a replacement or adjustment is required. Many of the static air mattresses and cushions will actually increase pressure if inflated too much. Additionally, the foam derived products must be monitored for replacement as the foam crushes and does not re expand after continuous use.

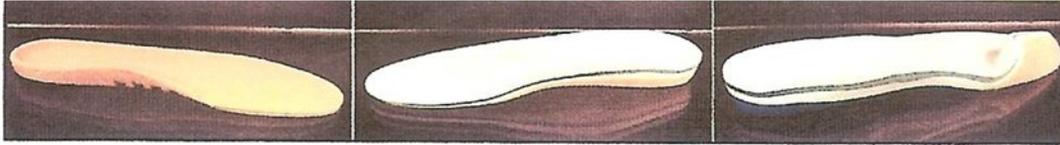
Heel lift, orthotics (diabetic inserts and shoes), cam walkers, etc... must be examined frequently for wear as well. Many of these products are specially made to fit a person foot out of a foam based product. To assess for wear, first assess the shoe itself, next the patient’s foot. Tale tell signs of the need for shoe replacement are erythema, callous formation, and ultimately ulcer formation. Keep in mind that diabetic patients may not be able to feel their feet due to neuropathy, so it is important to inspect both feet.

Figure 7-G Various inserts and shoes used in wound care. Notice the depth of the custom orthotic (F) to allow room for custom inserts.

A) Off the shelf

B) Custom Molded

C) Custom with toe filler



D) Half shoe (toes)

E) ¾ shoe (heel)

F) Custom orthotic



Below is a table of some of the more frequently used bed and chair offloading devices.

Product Medium	Common Uses	Specifications
Foam	<ul style="list-style-type: none"> • Mattress overlays • Wheel chair cushions • Heel lift devices 	Mattress and cushions should be 3"-4" thick. Heel lift devices should elevate heel from all pressure.
Gel	<ul style="list-style-type: none"> • Mattress overlays • Wheel chair cushions 	Disperse pressure over a wide surface area.
Water mattresses or pads	<ul style="list-style-type: none"> • Mattress overlays • Wheel chair cushions 	Wave effect provides even distribution of weight.
Static Air	<ul style="list-style-type: none"> • Mattress overlays • Wheel chair cushions 	Air provides even distribution of weight. Not to be over inflated (causes too much pressure).
Alternating Air pressure	<ul style="list-style-type: none"> • Mattress overlays • Mattress replacement 	Alternating inflation and deflation of mattress tubes changes areas of pressure.
Low Air loss	<ul style="list-style-type: none"> • Mattress overlays • Mattress replacement 	Inflated air cushions that are adjusted to the patient's body size and weight. Pumps keep the desired pressure while allowing some air exchange.
Air fluidized	Bed replacement system	Contains very small beads that move under airflow to distribute weight. Provides air exchange for draining wounds but can also dehydrate compromised patients.
Kinetic therapy	Bed replacement system	Low air loss beds with capability of rotating patients 80 degrees. Used primarily for pulmonary indices.
Rotation	Bed replacement system	Bed frame that allows a patient to be rotated up to 360 degrees if needed. Rarely used.

Managing Skin Integrity

Skin becomes dry, flaky and less pliable when it loses moisture. Macerated (too moist) or overly dry skin is more susceptible to breakdown. A delicate balance must be achieved and often requires the daily use of moisturizers. Immobile patients on low air loss and fluidized air (high air loss) beds can also suffer dry skin secondary to increase air exchange. If left untreated, this can precipitate dehydration.

There are truly a staggering number of moisturizers available over the counter and by prescription. Some of the prescription moisturizers are compounded with steroids, histamines, vitamins or a number of medications to help treat the skin. It is important to understand the base compound of each product in order to determine the length of effectiveness in regards to moisture replacement or barrier effect.

Key Tips when treating Pressure Ulcers

Treatment follows the four basic steps common to all wound care:

- 1) Debride necrotic tissue and clean the wound to remove debris
- 2) Provide a moist wound-healing environment through the use of proper dressings
- 3) Protect the wound from further injury
- 4) Provide nutrition essential to wound healing.

Patients should be instructed to change positions every two hours while lying down. While sitting, positions should be changed every hour with slight “weight shifts” every 15 minutes. For the patient reclining, be sure and instruct them on the forces of friction and shear and the role these play in the development of pressure ulcers.

Lotions	Dissolved powder crystals held in suspension by surfactants. These have a higher water concentration and evaporate faster than any other type of moisturizer.
Creams	Made of oil and water, they are more occlusive than lotions and have to be reapplied less frequently than lotions. Creams are better for preventing moisture loss due to evaporation than for replenishing skin moisture. Creams are especially useful and are recommended to be applied 3-4 times per day for patients on low or high air loss therapy beds.
Ointment	Are preparations of water in oil (usually lanolin or petroleum). They are the most occlusive and longest lasting form of moisturizers. Studies have indicated that petroleum is a more effective moisturizer than lanolin.

Develop an appropriate diet and exercise program for your patient or consult a registered dietitian to assist with this planning. Encourage all patients with wounds (unless otherwise directed from the physician) to maintain adequate hydration levels. This would represent Eight 8 ounce glasses of water each day for the “normal” patient. Also encourage your patient to take a multivitamin and to increase his intake of protein. Wound care patients should, at a minimum, have 3 servings of protein daily, or supplement with protein enriched supplements.