REVIEW ARTICLE

Wound Healing and Nutrition: Going Beyond Dressings With a Balanced Care Plan

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Abstract As the largest organ of the body, the human skin protects all subcutaneous tissues. Despite its many attributes, the skin is vulnerable to pressure ulcers. The number of pressure ulcers and venous leg ulcers is on the rise, but healing rates have not improved over the past decade. The reason may be a tendency to focus on one or two fundamentals of wound healing, but not on all 3 fundamentals equally. The 3 fundamentals of wound healing are (1) pressure relief and nursing care, (2) dressings, and (3) nutrition. Nutrition is the area that is most often overlooked, which commonly causes the care plan to be out of balance. In the United States, few clinicians would consider malnutrition to be an issue in the homecare and long-term care setting, yet nutritional status and risk for pressure ulcer formation are well documented and strongly correlated. Our aging population will continue to survive previously catastrophic events, only to present with pressure ulcers or the potential for developing pressure ulcers. Clinicians caring for residents with pressure ulcers must strike a balance between pressure relief, dressings, and nutrition. Functional gastrointestinal-tract impairments must be diagnosed and addressed. Wounds must be treated aggressively with high-protein calorically-balanced diets because wounds heal from the inside out.

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Consider the human skin. As the largest organ of the body, it protects all subcutaneous tissues. Through most of our life, it keeps water and microbes out yet keeps fluids and electrolytes in. It senses the difference between hot and cold, regulates temperature, is tough yet resilient, and renews itself from the inside while losing 30,000 to 40,000 dead skin cells from the outside every minute. It synthesizes vitamin D, blocks ultraviolet radiation, and is key to our sense of touch. It comes in many types, from dry to oily, and in a wide variety of colors, and it usually repairs itself.

Despite all these attributes, the skin is vulnerable to pressure ulcers. The number of pressure ulcers and venous

leg ulcers is on the rise. For example, studies indicate that venous leg ulcers affect approximately 1% of adults in the Western world, and many individuals endure multiple treatment regimens because of recurrence rates as high as 70% for those at risk.¹ One reason for this dilemma is that we are beginning to outlive our skin.²

Between 1900 and 1902, the average life span (ALS) in the United States was 49.5 years. A 10-year increase in ALS occurred 30 years later (1929–1931: ALS = 59.2 years) and again 30 years after that (1959–1961: ALS = 69.9 years).³ Steady advances in medicine, such as widespread antibiotic use, the chemotherapy era in the 1940s, advancements in cardiac care in the late 1960s, and advances in critical care treatment protocols, helped the U.S. population increase its ALS to 77.9 years in 2007.⁴ Medical events that would have killed portions of the population decades ago continue to be mitigated by

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Figure Wound Healing: The 3-Legged Stool Concept: First Leg, Pressure Relief and Nursing Care; Second Leg, Dressings; Third Leg, Nutrition

medical advances, leaving a larger number of debilitated people to be cared for in a variety of settings.

In U.S. acute care facilities alone, an estimated 2.5 million pressure ulcers are treated each year. A Dutch study found that costs associated with care of pressure ulcers were the third highest, after the costs for cancer and cardiovascular diseases. The price of managing a single full-thickness pressure ulcer is as much as \$70,000, and U.S. expenditures for treating pressure ulcers have been estimated at \$11 billion per year.⁵ The development of pressure ulcers may also have important legal consequences: failure to prevent pressure ulcers in long-term care settings has resulted in increasing litigation, with settlements favoring long-term care residents in up to 87% of cases.⁶ These consequences highlight the value of preventing pressure ulcers.

Pressure ulcers are areas of soft tissue breakdown that result from sustained mechanical loading of skin and underlying tissue. They can develop either superficially or deep within tissues, depending on the nature of the surface loading and the tissue integrity.^{7,8} The superficial type forms within the skin, with maceration and detachment of superficial skin layers. If allowed to progress, the damage may form an ulcer that is easily detected. By contrast, deep ulcers arise in muscle layers covering bony prominences and are mainly caused by sustained compression of the tissues. These ulcers develop at a faster rate than superficial ulcers do and yield more extensive ulceration with an uncertain prognosis. Pressure ulcers in subdermal tissues under bony prominences very likely occur approximately between the first hour and 4 to 6 hours after sustained loading.⁹ The data used to determine this time frame were acquired in studies of patients who

were lying down. Muscle and fat tissue loading under bony prominences during sitting is substantially greater than when the patient is lying down, so the onset of pressure ulcers and deep tissue injury while sustaining a sitting posture is likely to occur sooner than when a patient is recumbent in supine or side-lying positions.¹⁰

Although several clinical practice guidelines and systematic reviews are available to guide treatment decisions, healing rates have not improved over the last decade.¹ This may be explained by the tendency to focus on one or two fundamentals of wound healing, and not all 3 fundamentals equally. A 3-legged stool analogy (see the [Figure](#)) will put the 3 wound-healing fundamentals into perspective.

The 3-legged stool analogy has been used to explain everything from religion to finance, from society to business and life strategy. In short, it is a concept of balance in which focus (lengthening) or nonfocus (shortening) on one leg of the stool will make the whole stool out of balance. If a balanced stool is too short to reach the clinical goal, one cannot merely focus (lengthen) a single leg to increase the overall height, but rather all 3 legs of the stool must be addressed equally to achieve a balanced care plan.

Pressure Relief and Nursing Care

If a pressure ulcer involves a circumscribed area such as an elbow or heel or the back of the head, and if the patient is able to reposition the rest of his or her body independently, then the use of positioning devices to raise the involved area off the support surface may be adequate for healing.¹¹ If the pressure ulcer involves an area that is not circumscribed, a care plan will need to be deployed to alternate pressure to several areas in order to promote healing in the affected area while preventing other areas of damage.

If the patient is no longer at risk for developing pressure ulcers, positioning devices may reduce the need for pressure-reducing bed mattress overlays. Avoid using donut-type devices as these cause arterial and venule capillary compression that may compromise local blood perfusion. A study of at-risk patients found that ring cushions are more likely to cause pressure ulcers than to prevent them. Written repositioning schedules should be developed even when patients are using a pressure-reducing support surface. There are numerous reports that patients develop pressure ulcers while using pressure-reducing support surfaces, regardless of the type of surface.¹¹ These surfaces serve only as adjuncts to strategies for positioning and careful monitoring of at-risk patients.

Dressings

While no longer recommended, wet-to-dry dressings were used historically to debride devitalized tissue. One disadvantage of wet-to-dry dressings is that they are

Table 1 The Categories of Wound Care Products Available Today Offer Clinicians a Litany of Choices

Absorptive Dressing	Collagen	Fillers (Wound)	Hydrogel (Multiple Forms)	Skin Care
Alginates	Compression dressings/wraps	Foam dressings	Measuring/miscellaneous devices	Skin substitutes
Antimicrobials	Composite dressings	Growth factors	Negative pressure wound therapy	Tissue engineering
Cleansers	Contact layer dressings	Hydrocolloid	Odor absorbing	Transparent films
Closure devices	Enzymatic debriders	Hydrofiber	Scar therapy	

nonselective; when removed, they strip both nonviable and viable tissues and are therefore potentially traumatic to granulation tissue and especially to new epithelial tissue. Adequate analgesia should be provided when this method is used.¹¹

Following the cardinal rule to keep the ulcer tissue moist and the surrounding intact skin dry is of greater importance than the specific brand of dressing. In 5 controlled trials in which moist saline gauze and other types of moist wound dressings were compared, no significant differences were noted in pressure ulcer healing outcomes. On the basis of these results, clinicians may select a suitable dressing that supports moist wound healing.¹¹ See [Table 1](#).

Hydrocolloid dressings were introduced in the 1980s and demonstrated both the ability to maintain a moist wound environment and superior absorption of wound exudate compared with transparent dressings. Differences in these dressings generally relate to their exudate handling capacity.

Future trends in dressing development appear to include dressings impregnated with anabolic steroids and growth factors to encourage production of granulation tissue and to augment other developments in wound care that include gene therapy and tissue-engineered constructs.

Nutrition

Nutrition is the fundamental area of wound healing that is the most often overlooked, which commonly causes the care plan to be out of balance. Manufacturers' representatives focus attention on their specific wound care devices and products (lengthening those legs), but often no equal advocate exists to focus needed attention on nutrition. In the United States, few clinicians would consider malnutrition to be an issue in the homecare and long-term care setting, but they would be wrong.

The nutritional status of 232 nursing home patients (mean age 72.9 ± 12 years) was determined by biochemical and anthropometric measurements. Overall, the incidence of some degree of malnutrition was 59%; 17 of the patients were found to have pressure ulcers and were malnourished. When classified as having mild, moderate, or severe malnutrition, the patients with pressure ulcers were in the severe group. The conclusion was that the development of pressure ulcers correlates with nutritional deficiencies.¹²

Not only is nutritional intake essential for proper wound healing, but wound healing itself increases the demand for calories and protein. In a comparison of 14 tube-fed nursing home patients with pressure ulcers and 12 tube-fed patients without ulcers (the controls), despite increased calorie and protein intake, the pressure ulcer patients had worse biochemical measures of nutritional status and lower serum albumin and hemoglobin levels. The tube-fed nursing home patients with pressure ulcers were malnourished despite receiving a diet high in calories and protein.¹³ In many instances, even for a patient with a functional gastrointestinal tract, it may be difficult or not possible to provide enough enteral feeding intake to satisfy the greatly increased requirements for calories and protein without causing fluid overload and diarrhea.

It is common to see a decrease in appetite and undesired weight loss in sick patients. The incidence of pressure ulcers in 2,393 patients from 29 nursing homes and 4,067 patients from 22 hospitals was studied, and in both groups pressure ulcers were significantly related to undesired weight loss (5%-10%), low nutritional intake, and low body mass index (<18.5).¹⁴

Nutritional status and risk for pressure ulcer formation are well documented and strongly correlated. Deficiencies in some or most nutrients needed for wound healing may occur based on dietary intake, malabsorption, or protein stress factors such as chronic obstructive pulmonary disease, wound healing, or infection. Protein depletion appears to delay wound healing by prolonging the inflammatory phase, by inhibiting fibroplasia and proteoglycan synthesis and neoangiogenesis (proliferation phase), and by inhibiting wound remodeling.^{15,16} In a study of 108 human patients with experimental wounds, individuals with either low serum protein or serum albumin were found to have significantly weaker wound healing than those with normal protein values.¹⁷

From the studies, we see that monthly nutritional assessments are indicated for long-term care residents, followed up with a nutritional intervention plan. The intervention plan is the essential component of the clinician's approach to pressure ulcer prevention and treatment—and the often overlooked third fundamental or third leg of the stool. Nutritional intervention uses the assessment parameters of current nutritional status and estimated nutrition needs to address the etiology of the malnutrition and create a corrective action plan. Look at the whole patient. If the resident's serum albumin is below

3.4 gm/dL and the resident is consuming adequate protein by the oral or enteral route, where is the protein going? Is a functional gastrointestinal tract impairment preventing the absorption of the ingested protein?

Nutritional Intervention Plan

How many times have you heard the phrase, If the gut works, use it? For elderly patients, liquid protein formula supplementation has been found to significantly enhance healing of pressure ulcers, and the change in ulcer area was significantly correlated with the amount of protein in the diet.¹⁸

If the gut doesn't work, find out why. Efficiency of enteral absorption is proportional to the colloid osmotic pressure. Hypoalbuminemia reduces enteral absorption efficiency, and continuing to feed these residents calorically dense foods or formula leads to osmotic diarrhea. Do not overlook parenteral nutrition to correct severe protein-calorie malnutrition and hypoalbuminemia.

Conclusion

Evidence shows that with medical advances, our aging population will continue to survive previous catastrophic events but present with pressure ulcers or the potential for developing pressure ulcers.² Clinicians must be vigilant to assess this risk and create a pressure relief care plan for all residents and homecare patients. When caring for residents with pressure ulcers, a balance between the 3 fundamentals of wound care—pressure relief, dressings, and nutrition—is essential. No one parameter should be stressed more than the others. The 3-legged stool analogy stresses this balanced care plan.

Weight loss or declining serum albumin levels are indicators that a resident is at risk for developing a pressure ulcer. If the resident's nutritional status declines, find out why. Functional gastrointestinal tract impairments must be diagnosed and addressed.

Aggressively treat wounds with high protein and calorie diets because wounds heal from the inside out.

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