Back to Basics: Nutrition as Part of the Overall Wound Treatment Plan

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Over the past decade, advancements in wound care have revolutionized wound healing outcomes. Cutting-edge interventions and innovative products and techniques are helping wound care become a topic of interest in scientific research. With exciting new findings and high-tech treatments in the spotlight, it may be easy to overlook the role that basic nutrition plays in wound care management. It is important to address adequate nutrition and hydration early on, because poor nutritional status can prolong the inflammatory phase of healing and decrease collagen synthesis and fibroblast proliferation.

Individuals who are malnourished experience more complications and infections, which worsen their medical condition and decrease their survival rate; wound care interventions are less effective in the presence of malnutrition. Given the importance of decreasing readmission rates and improving quality of life, it makes sense to tackle issues of nutritional deficiency and dehydration from the beginning. This article discusses the detrimental effects of malnutrition, reinforces the importance of a well-balanced diet for wound healing, and provides specific nutrient recommendations to incorporate into treatment plans.

Malnutrition: Identifying Individuals at Risk

Almost all healthcare professionals agree about the need for proper nutrition, but 40% to 60% of hospitalized older adults and up to 60% of home care patients are still malnourished. Malnutrition is known to negatively affect the wound healing process, resulting in infection, increased wound complications, and delayed wound resolution. The causes of malnutrition are multifactorial and can relate to physical limitations, functional decline, self-feeding deficits, decreased appetite, environmental changes, new disease onset, or psychosocial factors. Accurate and timely nutrition screening and assessment to identify patients prone to skin breakdown are essential to wound healing and to the patients’ overall health and recovery.

Common signs of malnutrition include decreased grip strength related to muscle loss, decayed or missing teeth, spoon-shaped nails, and skin color loss. The most efficient method of identifying at-risk individuals is through nutrition screening and assessment (eg, the Mini Nutritional Assessment [MNA®] — www.mna-elderly.com — or the DETERMINE Checklist — nutritionandaging.fiu.edu/downloads/NSI_checklist.pdf). If a patient appears undernourished, he/she should be referred to a registered dietitian (RD) to ensure appropriate interventions are initiated promptly. All efforts should encourage proper nutrition that incorporates the specific nutrients linked to wound healing.

Important Nutrients for Wound Healing

The process of wound healing demands a great deal of energy. Adequate calories are needed to support normal bodily functions, as well as tissue regeneration and repair. Although no evidence-based recommendations are available for energy requirements, the revised guidelines from the National Pressure Ulcer Advisory Panel (NPUAP) and the European Pressure Ulcer Advisory Panel (EPUAP) recommend 30–35 kcal/kg/day. Individual energy needs depend on a variety of factors and require adjustments according to age, gender, nutritional status, comorbid conditions, activity level, wound severity, and stage in the healing process. In addition, it is necessary to assess nutrients lost in wound exudate and replace them as appropriate.

Healthcare providers should emphasize foods dense in macronutrients — ie, carbohydrates, protein, and fat. Oral intake often remains insufficient because of poor dentition, difficulty swallowing, neurological pathologies, or excessive energy demands. High-calorie/high-protein oral nutrition supplements such as Ensure® (Abbott Nutrition, Columbus, OH) often are recommended to help achieve adequate nutrition, prevent or combat unintended weight loss, and fill in any nutritional gaps.

Carbohydrates. Carbohydrate is the body’s main source of energy and prevents gluconeogenesis when the body is forced to convert protein stores for energy use. An inadequate supply of carbohydrates can lead to muscle...
wasting, subcutaneous tissue loss, and poor wound healing. Whole grains, fruits, and vegetables with complex carbohydrates are the preferred source.

Comorbid conditions such as diabetes affect how the body metabolizes carbohydrates in the diet. An RD can modify the type and amount of carbohydrates to ensure optimal blood glucose control. Hyperglycemia is shown to increase the risk of infection and impair wound healing. Approximately 15% of individuals with diabetes develop a foot ulcer, and 84% of those will eventually undergo lower leg amputations. Therefore, it is imperative to maintain optimal glycemic control to ensure adequate and timely wound healing.

**Protein.** Similar to increased energy needs, additional protein is required to promote tissue growth and cell renewal. Protein plays an important role throughout all phases of wound healing. Amino acids, the building blocks of protein, are responsible for collagen and connective tissue synthesis, cell multiplication, and the initiation of a healthy inflammatory response. Different amino acids are responsible for various mechanisms in wound healing, and a deficiency can contribute to decreased tensile strength and delayed wound healing. All amino acids contribute to wound healing, but arginine and glutamine have received extensive study. These amino acids are needed in greater amounts and become essential substrates in stressed adults.

The NPUAP and EPUEP recommend protein intake of 1.25–1.5 g/kg/day. Clinicians should encourage patients to consume complete proteins, such as meat, poultry, fish, eggs, milk products, and soybeans. Excessive amounts of protein (>2 g/kg/day) should be only cautiously recommended for individuals with preexisting renal or hepatic conditions.

**Fat.** Dietary fat is the most concentrated source of energy and triglycerides. Fat provides energy for the proliferative phase of healing and provides the building blocks for epidermal and dermal tissues. Fat carries the fat-soluble vitamins A, D, E, and K. It also provides insulation under the skin and padding to bony prominences. Meat, eggs, dairy products, and vegetable oils contain fat. The four major dietary fats in the foods we eat are saturated fats, trans fats, monounsaturated fats, and polyunsaturated fats (PUFAs). Researchers are looking to broaden the use of PUFAs for managing the inflammatory response during wound healing. PUFAs are essential components of the phospholipid bilayer, regulate a wide range of bodily functions, and are precursors to several molecules involved in the inflammatory process. PUFAs are classified by their chemical structure and are characterized as either omega-3 or omega-6 fatty acids. Omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are believed to elicit anti-inflammatory protective effects, but their implication for use in wound treatment is not fully understood.

**Vitamin C.** Vitamin C has many physiological functions in the human body. It often is included in wound management because of its role in collagen formation. Vitamin C also provides tensile strength to newly built collagen; otherwise, new tissue could not stretch without tearing. The main sources of vitamin C include citrus fruits and juices, strawberries, tomatoes, red bell peppers, potatoes, broccoli, and cantaloupe. Currently, no convincing evidence shows that patients with wounds should routinely receive vitamin C supplementation, unless a pre-existing deficiency exists. However, vitamin C often is recommended for its other roles in the body, such as improving immune function. Plus, it is inexpensive and does not typically elicit any tolerance problems or cause adverse events.

**Zinc.** Zinc, a cofactor for collagen formation, also metabolizes protein, liberates vitamin A from storage in the liver, assists in immune function, and is involved in the biosynthesis of RNA and DNA. Although the effect of zinc on wound healing has not been the subject of extensive study, it remains a hot topic. Currently, zinc supplementation is warranted only in the presence of a deficiency. Increased wound drainage, excessive gastrointestinal losses, or inadequate dietary intake for long periods of time may

### Table 1. Risk factors of select micronutrient deficiencies in adults

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<thead>
<tr>
<th>Nutrient</th>
<th>Risk factors for deficiency</th>
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<tbody>
<tr>
<td>Vitamin A</td>
<td>Fat malabsorption, as seen in short bowel syndrome, chronic diarrhea, pancreatic insufficiency, cystic fibrosis, and celiac disease</td>
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<tr>
<td>Vitamin C</td>
<td>Low serum levels reported in critically ill patients, dialysis patients, and bariatric surgery patients</td>
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<tr>
<td>Copper</td>
<td>Deficiency is uncommon, but reported in patients with burns, celiac disease, gastric surgery, and long-term enteral and parenteral nutrition administration. Prolonged zinc supplementation may cause copper deficiency</td>
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<tr>
<td>Zinc</td>
<td>Increased gastrointestinal (GI) losses and decreased GI absorption: Crohn’s disease, celiac disease, chronic diarrhea, short bowel syndrome, and high-output GI fistulas. Copper supplementation cause zinc deficiency. Also seen in trauma, burns, HIV, and pancreatic insufficiency</td>
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trigger a zinc deficiency. Zinc is abundant in protein-rich foods such as meat, oysters, and liver.

**Vitamin A and copper.** Vitamin A and copper also contribute to the wound-healing process. Vitamin A stimulates the immune system, maintains mucosal and epithelial integrity, and increases collagen formation. Dietary sources of retinol, the active form of vitamin A, include fortified milk, cheese, cream, butter, margarine, eggs, liver, and fish-liver oil. Dietary sources of beta-carotene, a precursor to vitamin A that is converted in the body, include dark-green leafy vegetables, deep orange fruits and vegetables, spinach, broccoli, cantaloupe, carrots, sweet potatoes, pumpkin, and winter squash. Copper is important for the production of enzymes involved in the cross-linking of connective tissue. The best dietary sources of copper are organ meats, seafood, nuts, seeds, and dark-green leafy vegetables. Table 1 summarizes the risk factors for deficiency of these four key nutrients.

**Practice Points**

Optimal nutrition plays a role in the treatment and prevention of pressure ulcers. It is imperative to identify malnutrition early and implement appropriate strategies for correcting nutritional deficits. Healthcare professionals should monitor dietary patterns frequently to ensure nutrition interventions are modified as patients’ conditions change. It is of upmost importance that patients meet their protein and energy requirements. Well-balanced meals that include carbohydrates, protein, fat, and adequate vitamins and minerals should be encouraged. If patients are unable to meet their nutrient needs through daily intake, an oral nutrition supplement would prove beneficial. Incorporating nutrition as part of the overall treatment plan promotes healing, decreases treatment duration, and improves overall quality of life.

**References**