

# Zinc Supplementation for Pressure Ulcer Management:

## Clinical Considerations in the Absence of a Definitive Test for Zinc Deficiency

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### Introduction

**Z**inc supplementation is often initiated in patients with pressure ulcers; however, there is no consensus and much debate in the literature regarding zinc supplementation to improve wound healing. This is the result of a number of factors, including the difficulty of conducting a randomized controlled trial that singularly and definitively identifies zinc as the key factor and the lack of an assessment tool to determine zinc status.<sup>1-3</sup>

Zinc is a mineral that functions in approximately 100 enzymatic reactions. It plays a role in protein synthesis, collagen formation, cell proliferation, immune function and cellular reactions at the level of DNA and RNA, among myriad other functions.<sup>4,5</sup>

Symptoms of zinc deficiency include appetite loss, blunted taste and smell sensations, increased risk for respiratory and recurrent infections, seborrhea-like dryness and redness of the nasolabial fold and eyebrows, impaired immune function and impaired wound healing.<sup>6,7</sup> Zinc deficiency may be suspected where there is significant wound exudate, delayed wound healing, hair loss, long-term corticosteroid therapy, advanced age, poor nutritional intake, malabsorption, a hypermetabolic state (e.g. physiological stressors) or sepsis.<sup>4,5,8,9</sup>

The literature supports zinc supplementation for pressure ulcer management when there is zinc deficiency. The nutrition recommendations from the National Pressure Ulcer Advisory Panel–European Pressure Ulcer Advisory Panel *International Guidelines for Pressure Ulcer Prevention and Treatment* suggest that vitamin and mineral supplements should be offered when dietary intake is poor or deficiencies are confirmed or suspected;<sup>10</sup> however, the literature also states that there is no evidence for zinc supplementation for pressure ulcer healing when the patient is not zinc deficient.<sup>3,4,8-10</sup>

### The dilemma regarding zinc supplementation

There are no universally accepted methods to assess zinc status definitively and accurately; no single test accurately determines an individual's true zinc level.<sup>2,3</sup> Many

studies conducted on zinc status and supplementation have used plasma zinc to quantify deficiency; however, plasma zinc levels are homeostatically regulated, are affected by a number of factors and do not necessarily correlate to tissue levels.<sup>11,12</sup>

Dietary reference intakes indicate the level of each micronutrient (vitamin or mineral) needed at each stage of life for *healthy* individuals.<sup>13</sup> When clinicians are presented with patients challenged with a pressure ulcer either alone or in combination with other compounding issues (e.g. acute illness, chronic disease, infection, physical or cognitive barriers to optimal nutrition), they must use their clinical judgment, based on a number of factors, when considering zinc supplementation. Indeed, one author has noted: "The goal for zinc supplementation should be to replenish the body's zinc concentrations in the presence of known or suspected deficiency without providing excessive amounts."<sup>14</sup>

### Considerations

#### Adequacy of intake

It is important to obtain information about patients' typical pre-admission intake of zinc sources, as well as their current intake. To guide the decision to initiate zinc supplementation, clinicians should review the zinc content of all vitamin/mineral supplements, oral nutrition supplements, over-the-counter zinc-containing lozenges marketed to boost the immune system and enteral formulae that the patient receives, and consider these in addition to his/her typical daily intake of zinc from foods.<sup>10</sup> Note that many nutrient analysis programs do not contain complete data for zinc, as this information is often not provided by the food manufacturer; therefore, an analysis of food intake records for zinc adequacy may not be accurate.

#### Key sources of dietary zinc

The key food sources of zinc are meats (e.g. beef, chicken, turkey, pork), fish and seafood (especially oysters), liver, eggs, milk, beans, whole-wheat products and wheat

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germ. It is important for healthcare facilities to review their menus for zinc-containing sources. Any condition that affects intake will negatively affect optimal zinc status. The key food sources of high-quality protein overlap significantly with those of zinc and iron.

#### Routes and extent of losses

It is essential that clinicians consider not just intake, but also routes and extent of zinc losses. Zinc is absorbed primarily in the small intestine; however, only 20–40% of ingested zinc is absorbed. Zinc absorption is impaired by intestinal disorders that decrease absorption or increase losses. The primary route of zinc loss is the gastrointestinal tract.<sup>15</sup> A patient who presents with frequent loose stools or emesis may be losing excessive amounts of zinc.

The second greatest loss of zinc is via the urinary tract. Patients who are receiving diuretics or who have uncontrolled diabetes or hyperglycemia (which can be caused by the stress response to trauma, steroids and other factors) will lose excessive zinc. The aging kidney is less able to concentrate urine; therefore, older adults lose a greater amount of zinc via the urinary tract, even under normal conditions. Zinc is further lost in wound exudate.<sup>4,8,16</sup> Patients who present with one or multiple exudative wounds are at risk for impaired zinc status. In addition, fistulae are sources of potentially large zinc losses. Chest tubes and subcutaneous wound drains also contribute to zinc losses.<sup>8</sup>

High fibre and phytate intake decrease the amount of zinc absorbed in the gastrointestinal tract. Phytate found in cereals, legumes and nuts inhibits zinc absorption, while protein facilitates zinc absorption.<sup>17</sup> Therefore, vegetarians may need up to 50% more zinc than non-vegetarians.

#### Knowledge about patient populations

The current literature indicates that healthy older adults living in the community are at high risk for zinc deficiency and that this deficiency is readily resolved by supplementation. Should a physiological stressor or barriers to optimal intake occur, further strain will be placed on the elderly person's marginal zinc status.<sup>18,19</sup>

An article in the journal of the Dietitians of Canada reported suboptimal zinc status in university students, a population previously not considered at risk for zinc deficiency.<sup>20</sup>

#### Biochemistry

Albumin is the primary zinc carrier, transporting zinc throughout the body. If a patient has hypoalbuminemia, then the bioavailability of zinc is impaired, since zinc

absorption declines when plasma albumin is low. This can occur with trauma, acute stress, infection or sepsis, inflammation, surgery, cortisone excess, over-hydration and protein/energy malnutrition.<sup>8,21</sup>

Nutrition/hydration-related blood work is only one of many components of a comprehensive nutrition assessment. Because blood work may not be readily available and waiting for results can further delay nutrition intervention, many other considerations must be taken into account when determining the appropriateness of supplementation. Diagnosis, changes in weight status and medications must also be considered.<sup>10</sup>

Dentition, dysphagia, preferences, appetite and avoidance issues that affect the intake of zinc-containing foods will negatively affect zinc status. It should be noted that the patients at greatest risk for malnutrition and dehydration are those who are dependent on others for food and fluids.

The recommended daily intake for zinc for healthy adult males and females is 11 and 8 mg, respectively. The tolerable upper limit for zinc in healthy adults – the level of intake that is likely to pose no risk of adverse effects – is 40 mg/day.<sup>13</sup> Many daily complete multivitamin/mineral supplements contain 15 mg of zinc; initiating such a supplement for a patient at risk for, or who presents with, a pressure ulcer is prudent. Only 20% of zinc in an orally administered supplement will be bioavailable.<sup>17</sup> Patients with non-healing stage III or IV pressure ulcers are often given 25–50 mg elemental zinc once or twice daily. Because this can exceed the tolerable upper limit, especially when intake from food and other sources is taken into account, supplementation should not continue long term.<sup>22–24</sup> One recommendation for zinc supplementation to enhance wound healing is 40 mg elemental zinc for 10 days.<sup>25</sup> Another author wrote that zinc is often used for non-healing pressure ulcers in a dose of 15 mg/day; re-evaluation within 4–6 weeks is recommended.<sup>26</sup>

In my own practice, I do not exceed 25 mg elemental zinc twice daily, and typically suggest 25 mg elemental zinc once daily (as gluconate; 175 mg zinc gluconate = 25 mg elemental zinc) for 4–6 weeks following a comprehensive nutrition assessment using informed clinical judgment. Before initiating supplementation, it is important to consult with a pharmacist for guidance regarding potential drug and nutrient interactions.

#### Adverse effects of zinc supplementation

Acute zinc toxicity is rare. The potential adverse effects of chronic use include gastrointestinal distress,

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immunosuppression and secondary copper deficiency.<sup>3</sup> Another reported side effect of very high doses of zinc for extended periods is an increase in low-density lipoprotein cholesterol and a decrease in high-density lipoprotein cholesterol.<sup>27</sup> Some publications citing adverse effects of chronic zinc use have reported extremely large doses of zinc for long periods in individuals without unusual zinc losses or physiological stressors.<sup>28–30</sup>

While evidence-based studies and literature reviews are essential to guide safe and appropriate interventions in nutrition and healthcare, these studies utilize very specific and restrictive criteria. A generalized summary (i.e. “There is no evidence for...”) based on these restrictive criteria of reviews may lead clinicians to abandon a potentially valuable intervention without applying appropriate clinical judgment. There are various levels of evidence, from randomized controlled trials to expert opinion. One may be stronger than the next, but none is without merit.

Additional research is required to determine the effects of various medical nutrition therapy interventions, including zinc, on pressure ulcer healing.<sup>10</sup>

While it is not appropriate to recommend zinc supplementation strictly on the basis of the presence or stage of a pressure ulcer, neither is it appropriate to deem zinc supplementation for pressure ulcer management ineffective in all cases. Evidence to date is from a minimal number of studies that fall under the strict criteria of evidence-based publications or from small or poorly conducted studies with inconclusive evidence. There is a significant lack of large clinical trials investigating specific nutrition interventions, and more research is required.<sup>25</sup>

### Reflection and conclusion

This author receives numerous telephone and email enquiries requesting a “protocol” for nutrient supplementation for pressure ulcers. I am quick to dismiss the concept of protocol (i.e. supplement X nutrient in Y amount for any Stage Z pressure ulcer), as this effectively takes the individual, and considerations such as precautions and contraindications, out of the equation. In fact, these requests for information inspired this article as an example of the need for critical thinking and individualization when providing nutrition intervention for our patients.

The lack of a definitive and accurate measurement tool to determine if a patient has a suboptimal or deficient zinc status requires that clinicians apply sound judgment. This should be based on a comprehensive nutrition assessment that considers precautions of, indications for and contraindications to supplementation. ☺

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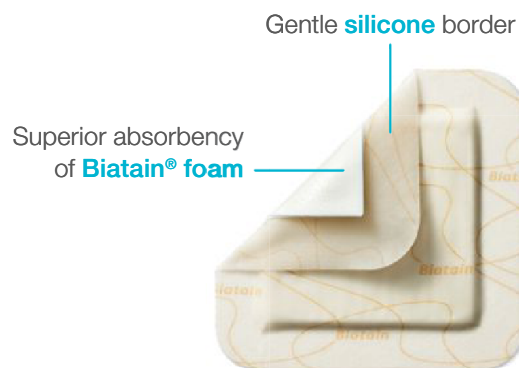
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