

Nutritional Support and Rehab

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Nutrients play a vital role in the body's healing process, and over 83 percent of all chiropractors consider nutritional counseling to be a valid nonadjustive technique.¹ Deficiencies of one or more of a wide range of nutrients can impair the healing process; conversely, ingestion of specific nutrients can help accelerate the healing process. In this article, we will take a look at the use of specific nutritional support for the three phases of injury rehabilitation: the inflammatory phase, the healing phase, and the rehabilitation phase.

When the body is injured, it needs to be supplied with enough energy (calories) to meet the increased metabolic demands. These increases can range from 20 percent to 150 percent higher than basal metabolic rates, depending on the type and severity of the injury.^{2,3} Also, rapid induction of excess catabolism, caused by acute traumas, can result in a loss of body protein. At least 50 percent of the calories should come from complex carbohydrates, 20 to 30 percent from protein, with no more than 30 percent (preferably 20 percent) from dietary fat.

Phase I: Acute (Inflammatory) Phase

Phase I lasts from 48 to 72 hours, with some variability. During Phase I, the response to the injury includes pain, swelling, redness and heat. The primary nutritional response to inflammation is proteolytic enzymes (proteases).⁴ In addition, our bodies utilize fibrin, plasmin, thrombin and kinins to respond to inflammation. Apparently, localized deficiencies of enzymes can prolong inflammation and delay healing. Sometimes if the inflammation is severe enough, they are inactivated or cannot get to their sites of action. Therefore, supplementation of enzymes (such as bromelain) can be effectively beneficial.

However, the best clinical results can be obtained by using a combination of different enzymes in an enteric coated tablet, which protects enzymatic activity from HCL.^{5,6,7} The specific combination of pancreatin, bromelain, and trypsin/alpha chymotrypsin, along with papain, lipase and amylase, has proved to be very effective in treating the inflammatory responses associated with injuries. Depending on the type of injury, oral use of proteolytic enzymes can reduce healing times by up to 50 percent.⁴

Supplementation with proteolytic enzymes should begin as soon as possible following the occurrence of an injury. An initial loading of up to 10 tablets, followed by 3-5 tablets four times daily on an empty stomach is preferable. Tablets should be taken between meals (at least 30 minutes before a meal) and at bedtime, and should only be taken with water. Athletic applications may include daily supplementation during stressful training or competition to provide the immediate enzyme availability when the need arises.

Phase II: Repair Phase

Phase II usually lasts from 48 hours to about six weeks. This is the phase during which collagen production and formation occur. During this period, the use of proteolytic enzymes can still assist in keeping down stress induced inflammation at the injury site. Enzyme usage can be reduced to two tablets three times daily, and may possibly be discontinued after a week or so.

It is crucial to maintain adequate levels of vitamins and minerals during the repair phase. Almost any vitamin or mineral deficiency can adversely affect healing.^{2,3} Vitamin C, B vitamins, magnesium, calcium, manganese and zinc are involved in numerous reactions involved in all aspects of healing.^{8,9} Vitamin A is necessary for the repair of epithelial tissue. It is especially important to supply enough manganese (in a bioavailable form such as gluconate) to allow for the synthesis of proteoglycans.¹⁰

Inflammation during Phase I can generate large amounts of free radicals, overwhelming local antioxidants and damaging connective tissue, delaying healing.¹¹ Since antioxidant status is important, a full spectrum of antioxidant nutritional support can be utilized during Phase II.¹² This support should include: antioxidant vitamins E and C; beta carotene; zinc and the trace minerals selenium and germanium; coenzyme Q10 (emulsified); antioxidant enzymes superoxide dismutase and catalase; taurine; methionine; and of course glutathione and N-acetylcysteine.

This is also the time to incorporate the use of purified chondroitin sulfates into the regimen. Chondroitin sulfates are mucopolysaccharides, which are an important part of connective and elastic tissues.

Chondroitin sulfates are produced by chondrocytes as long chains of sulfated modified sugars. Because of their location in connective tissue, chondrocytes have a poor nutrient supply. By supplying these cells with appropriate nutrients, as well as the building blocks for chondroitin sulfate synthesis, healing times can be improved.¹³

When chondroitin sulfates are purified, dietary intake can supply these building blocks, since purified chondroitin sulfates are readily absorbed.¹⁴ The key word here is purified. Some companies market products that are mixtures of trachea powder and papain as their chondroitin sulfate products. Absorption of chondroitin sulfate from these sources is very limited, due to the presence of crosslinked collagen. Only about 1-2 percent of chondroitin sulfate is available from sources such as trachea powder.

Some companies market products containing glucosamine as the building block source for chondroitin sulfate. Obtained from an acid hydrolysis of shrimp or lobster shells (chitin), glucosamine is an amino sugar necessary for the synthesis of chondroitin sulfate. Researchers have compared the effectiveness of glucosamine, N-acetylglucosamine and polymers of chitin in the acceleration of surgical wound healing. Wound healing was accelerated only three percent by glucosamine (not statistically significant), 9.9 percent by N-acetylglucosamine and 30 percent by chitin polymers.¹⁵ This study was an early work that led to the development of purified chondroitin sulfate for accelerating wound healing.

Glucosamine is very simple to produce, and therefore very inexpensive to obtain. A European company uses the sulfate salt of glucosamine. The sulfate salt costs more to produce, but the manufacturer feels the sulfur obtained from it is superior to the chloride form of glucosamine (starting form) for healing

(most of the published studies done with glucosamine sulfate are done with an injectable preparation). However, it takes rather large doses of glucosamine to accelerate injury rehabilitation. The manufacturer uses 4.5 grams of glucosamine per day, taken orally, to obtain publishable results. Their own scientists have concluded that "82 percent of glucosamine is, to a large extent, broken down to smaller fragments" when given orally. The smaller fragments they are referring to could only be the amino acid glutamine and sugar.^{16,17}

In 1992, Yoo, et al. published an article in *Spine* which detailed the suppression of proteoglycan synthesis (PGS) in chondrocytes derived from intervertebral discs (in vitro) by nonsteroidal anti-inflammatory drugs (NSAIDs).¹⁸ Because NSAIDs can inhibit PGS at three distinct enzymatic steps in chondroitin sulfate synthesis, the authors concluded that "the clinical use of NSAIDs needs to take into account the potential effect those medications have on the structural integrity of the spine." An article in the *Journal of Rheumatology* notes there is some clinical evidence implicating some of the NSAIDs in the development of osteoarthritis.¹⁹

Interestingly, glucosamine can only counteract the effect of one step of inhibition caused by NSAIDs; N-acetylglucosamine can counteract the effects of two steps of inhibition.²⁰ Only purified chondroitin sulfate appears to counteract the full effects of all three steps by nutritionally providing the limiting nutrients needed for PGS.

Based on the information available, it is clear to see that purified chondroitin sulfates are still the best choice for providing nutritional support for wound healing and connective tissue damage. A daily intake level of 2-3 grams in divided amounts should be sufficient to provide desirable results.

Phase III: Remodeling (Rehabilitation) Phase

During Phase III, often termed the remodeling phase of injury recovery, strengthening of connective tissue and muscle occurs through hyperplasia and hypertrophy. Phase III lasts minimally three weeks and may require up to and over 12 months to accomplish in certain injuries.

Connective tissues include cartilage, tendons, ligaments and bone. Cartilage is composed of 80 percent collagen and 20 percent proteoglycans by dry weight. Tendons and ligaments are predominantly collagen. Bone is an organic matrix that is strengthened by the deposits of calcium salts. The organic matrix of bone is 90-95 percent collagen fibers, with the remainder being termed "ground substance." The ground substance of bone includes proteoglycans (which are mainly chondroitin sulfate) and hyaluronic acid.²¹

The remodeling phase is dominated by anabolic repair. This anabolic phase of rehab is enhanced by supplying the nutrients which are in demand for growth. These include:

- 1) vitamin C, copper and vitamin B6 for collagen synthesis;
- 2) purified chondroitin sulfate for proteoglycan production;
- 3) antioxidants for free radical suppression;
- 4) B complex vitamins and minerals necessary for growth of healthy new tissue.²²

The primary minerals for rehab, other than calcium and magnesium, are manganese, zinc and copper. Organic forms of these minerals should be used to insure proper assimilation. Manganese, for instance, shows excellent clinical results when used in an organic form, and very little results when

used in an inorganic form. This is probably due to the fact that minerals such as manganese, copper and zinc, are formed in nature in organic chelate form. Plants chelate minerals with organic acids such as gluconates, and with amino acids such as glycines and aspartates.

Conclusion

An injured individual is able to recover much more rapidly, and will be less prone to re-injury if they are healed properly. Manipulative care and a well-designed exercise program work together in the rehabilitation process. Proper healing also requires that attention be given to the nutritive biomechanical needs of the injured person.

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